UNAM
UNIVERSITY OF NAMIBIA

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SCHOOL OF SCIENCE
Prospectus 2022

FACULTY OF AGRICULTURE, ENGINEERING & NATURAL SCIENCES

FACULTY OF AGRICULTURE, ENGINEERING & NATURAL SCIENCE PROSPECTUS 2022

SCHOOL OF SCIENCE

UNAM

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NOTE

Regulations and curricula for 2022 may be amended without prior notice. General regulations and information appear in the **General Information and Regulations and Fees Prospectus**.

Although the information contained in this faculty prospectus has been compiled as accurately as possible, Council and Senate accept no responsibility for any errors and omissions, which may occur. The University retains the right to amend any regulation or condition without prior notice.

The information is correct up to 15 December 2022.

The fact that particulars of a specific course or field of study have been included in this Faculty Prospectus does not necessarily mean that such programme, subject, or course will be offered in 2022 or any consecutive year.

This Faculty Prospectus must be read in conjunction with the **General Information and Regulations and Fees Prospectus**.

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FACULTY PREAMBLE

The mission of the Faculty of Science is to produce graduates of high caliber who will make a positive contribution to the socioeconomic development of Namibia and beyond, through the application of their knowledge and skills in various fields of science and technology. Given the past history, which did not encourage and promote effective teaching of science and mathematics, especially in the formerly disadvantaged communities, the Faculty particularly aims at promoting student interest in the learning and teaching of science; and producing good quality science graduates, who will help to build a science culture in society. The Faculty's principal objective is to promote the development of science, technology, and environmental studies, and to encourage and facilitate research activities, which address the new demands of the national economy.

All degree programmes in the Faculty of Science, just like all other degree programmes at the University of Namibia, were thoroughly revised to reflect the changing socioeconomic, biophysical and job market environments and the needs of the country. We now offer attractive degree programmes in all the seven Departments of the Faculty. The degree programmes in the Faculty of Science are of exceptional quality. They are designed to develop investigative skills and teach the tools of critical analysis and communication skills which are necessary pre-requisites for lifelong learning. Our programmes offer good employment opportunities and exciting future careers, and equip you with a unique blend of generic and discipline-related skills that give you the capacity to tackle problems with initiative and resourcefulness. The Faculty has close links with industry and will thus provide you with opportunities to explore various career options during your studies. Studying science gives you the innovative skills for an ever-changing employment environment and makes you a valuable resource for employers. Therefore, this is a particularly fascinating time to study science at the University of Namibia.

The world today continues to witness major technological advances which are opening up in many new areas. The boundaries between traditional subject areas are blurring as interdisciplinary research leads to rapid progress on a wide range of issues that underpin the future prosperity and quality of life in Namibia and the world at large. Such issues include biodiversity conservation; environmental management; pollution control; sustainable utilization of resources; combating effects of, and adaptation to climate change and desertification; cleaner energy production; genetically modified organisms; molecular and other new genetic advances in health, medicine and food technology; nanotechnology; biotechnology; new computing developments & ICT/IT; and many others. The comprehensive scope of the Faculty of Science allows us to offer courses and conduct research in these areas. By so doing, the Faculty of Science contributes immensely towards meeting the Vision and Mission of the University of Namibia. Through this, we are playing our part in helping Namibia achieve the goals set out in Vision 2030, the National Development Plans and the ETSIP targets.

We are proud of who we are and our achievements so far. We encourage you to join us for an exciting career in science.

ACADEMIC YEAR 2022

12 January	University Open
14 January	Start of Summer Term (Until 1 February)
24 January	Academic staff resumes office duties
14 February	Lectures commence for FIRST SEMESTER – Senior Students
28 February	Lectures commence for FIRST SEMESTER – First Year Students
11 April First	Semester BREAK commences
19 April	Lectures commence after first semester break
20 May	Lectures end for FIRST SEMESTER – Senior Students
31 May	Regular Examinations commence – Senior Students
07 June	Lectures end for FIRST SEMESTER – First Year Students
13 June	Regular Examinations commence – First Year Students
21 June	Regular Examinations end – Senior Students
24 June	Regular Examinations end – First Year Students
30 June	End of FIRST SEMESTER
04 July	Start of Winter Term (Until 08 July)
04 – 08	July Mid-year recess
11 – 15	July Special/Supplementary/Winter Term Examinations commence (Until 15 July)
DATE SECOND SEMESTER	
25 July	Lectures commence for SECOND SEMESTER
22 August	Second semester BREAK commences
29 August	Lectures resume after second semester break
21 October	Lectures end for SECOND SEMESTER
27 October	Regular Examinations commence
18 November	Regular Examinations end
28 November	Special/Supplementary Examinations commence (Until 2 December)
09 December	End of SECOND SEMESTER
16 December	End of academic year
09 January 2023	Start of Summer School (until 21 January)
12 January 2023	University opens (2023 academic year)
24 January 2023	Academic staff resumes office duties

DUE DATES FOR THE 2022 ACADEMIC YEAR

DATE	GENERAL DATES
21 January	Last day for appeals (Semester 2 & Double modules – Regular and Supplementary/Special examinations of November 2021)
14 January	Last day for application of retention of continuous assessment (CA) mark and Last day for application for exemption(s)
17 January	Last day for Late Registration (*Late fee payable*)
24 January	Last day for approval of exemption(s)
07 February	Last day for approval of module(s) & qualification changes
11February	Last day for recommendation of retention of continuous assessment mark and Promotion Examinations by Faculties
12 February	Last day for approval of retention of continuous assessment mark and Promotion Examination by Examinations Department
04 March	Promotion Examination
11 March	Last day for change of offering types at Regional Centres (Semester 1 modules)
29 April	Last day for Appeals (Semester 1 Modules - Regular and Supplementary/Special examinations of June 2019)
02Augustus	Last day to submit outstanding documentation
31 August	Last day to change offering types at Regional Centres (Semester 2 modules)
07 October	Last day to cancel enrolment
28 October	Last day to submit Theses and Dissertations for examinations
DATE	**CANCELLATION DUE DATES**
13 Mayl	Last day to cancel Semester 1 modules
07 October	Last day to cancel Semester 2 modules
07 October	Last day to cancel Double modules (module that extends normally over one academic year

DATE	FINANCE DUE DATES
18 March	Last day to cancel Semester 1 and Double modules with 100% credit
30 April	Last day to cancel Semester 1 modules with 50% credit
24 June	Last day to cancel Double modules with 50% credit
12 August	Last day to cancel Semester 2 modules with 100% credit
31 August	Last day to cancel Semester 2 modules with 50% credit

A. STRUCTURE AND PERSONNEL OF THE FACULTY

A.1. OFFICE OF THE DEAN

EXECUTIVE DEAN

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SCHOOL OF SCIENCE

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Ms. A. Amutenya: Grade. 6
General Assistant:

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A.3. ACADEMIC DEPARTMENTS

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Senior Lecturer:	Dr. T. Sibanda: BSc (Hons) (Midlands State University, Zim), MSc, PhD (University of Fort Hare, S.A)
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Senior Lecturer	Dr. N. P. Kadhila. BSc (China), MSc (UNAM)
Senior Lecturer:	Dr. R. Böck: M.Sc. (Saarbrücken/Germany), Ph. D (Oklahoma State/USA)
Senior Lecturer	Vacant
Lecturer:	Dr C Mukakalisa: BSc, MSc (UNAM)PhD (UNAM)
Lecturer:	Mr. H. Eiman: BSc (Hons), M.Sc. (UCT)
Lecturer:	Ms. S. Nafuka: BSc, MSc (UNAM) (on Study leave)
Lecturer:	Vacant
Tutor:	Ms. M.E Lang. BSc, MSc (UNAM)
Tutor:	Ms T Nawinda: BSc, MSc (UNAM)
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Senior Technologist:	Mr P Kapolo: BSc (UNAM)
Technologist:	Mr. A.T Mbangu: BSc, MSc (UNAM)
Technologist:	Mr. A. Hijarunguru: BSc (US)
Technologist:	Ms. K Kaitjizemine: BSc (UNAM)
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Senior Lecturer	Vacant **(OGONGO CAMPUS)**
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Professor	Vacant **(Computing)**
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Associate Professor:	Vacant **(Computing)**
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Lecturer:	Dr KM Kalili: BSc (UNAM), BSc-Hons, MSc, PhD (Stellenbosch University, RSA)
Lecturer:	Dr CV Raidron: BSc, HED (UNAM), MPhil (Murdoch University, Australia), PhD (UNAM)
Lectuer:	Dr P N Hishimone: BSc-Hons, MSc (UNAM), PhD (Kogakuin University, Japan)
Lecturer:	Dr P Dobreva: BSc, MSc (Uni. Sofia, Bulgaria), PhD (NMU, RSA)
Lecturer:	Mr G Uiseb: BSc (UNAM), MSc (Loughborough University, UK)
Lecturer:	Mr ID Davids: BSc, PGDE (UNAM), BSc-Hons, MSc (NWU, RSA)
Lecturer:	Mr EE Taapopi: BSc (UNAM), MSc (Uni.Ghana, Ghana)
Lecturer:	Mr NH Shafudah: BSc, MSc (UNAM), PhD. Eng (Kogakuin University)
Lecturer:	Mr NS Gariseb: BSc, MSc (UNAM)
Lectuer:	Ms T Amakali: BSc (UNAM), MSc (UCT, RSA)
Lecturer:	Mr PS Shanika: BSc (UNAM), MSc (UCT, RSA)
Lecturer (Chemistry):	Vacant
Lecturer:	vacant
Lecturer:	vacant
Lecturer:	Mr K Shiningayamwe: BSc, MSc (UNAM)
Lectuer:	Mr JH Naimhwaka: BSc, MSc (UNAM)
Assistant lecturer:	Ms M van Wyk: BSc (UWC); HED (UNAM); B. Ed (Hons) (UNAM); MSc (UNAM)
Tutor:	Mrs MM Nambinga: BSc, MSc (UNAM)
Tutor:	Mr PA Michael: BSc, MSc (UNAM)
Chief Technologist:	Mr W Song: B. Eng. (South East University. China)
Senior Technologist:	Ms M Nyambe: BSc (UNAM), BSc-Hons (Stellenbosch University, RSA), MSc (UNAM)
Senior Technologist:	Ms H Hakwenye: BSc (UNAM), MSc (UNAM)
Senior Technologist:	Ms N Shifeta: BSc (UNAM), MSc (China University of Geosciences)
Technologist:	Mr T Ndunge: BSc (UNAM)
Technologist:	Mr D Nanhapo: BSc, MSc (UNAM)
Technologist:	Mr O Mutenda: BSc (UNAM), PGDE (UNAM), BSc-Hons (NUST)
Technologist:	Mr H C Hofmann: National Certificate N3 (RSA), Trade Diploma (Namibia)
Technologist:	Mr E Tjingaete: Diploma in Mechanical Engineering (DGZ, Gemany)
Technologist:	Ms E Shilongo: Diploma in Education (Mutare, Zimbabwe), BEd (UNAM), MEd (UNAM)

DEPARTMENT OF GEOLOGY

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Head of Department:	Dr A. Vatuva: BSc. (UNAM), MSc. (University of Lorraine, France); PhD (China University of Geosciences Beijing, China), PDHE (UNAM)
Associate Professor:	**Vacant**
Associate Professor:	Prof H Sommer BSc. (University of Freiburg, Germany), MSc. (University of Freiburg, Germany); PhD (University of Mainz, German)
Senior Lecturer:	Prof A Tse : BSc. (Ahmadu Bello University, Nigeria), MSc. (University of Port Harcourt, Nigeria); PhD (University of Port Harcourt, Nigeria)
Senior Lecturer:	Dr I Muchingami BSc (NUST, Zimbamwe), PDHE, (NUST, Zimbamwe), MSc (NUST, Zimbamwe); PhD (UWC, South Africa)
Lecturer:	Dr G Chongwein : BSc (University of Buea, Cameroon), MSc. (University of Buea, Cameroon); PhD (Pan African University/University of Ibadan, Nigeria)
Lecturer :	Dr J Hamutoko: BSc (UNAM), MSc. (Brandenberg University of Technology, German); PhD (UNAM)
Lecturer:	Dr A. Vatuva: BSc. (UNAM), PDHE (UNAM) MSc. (University of Lorraine, France); PhD (China University of Geosciences Beijing, China)
Lecturer:	Ms S. Uugulu: BSc. (UNAM), MSc. (Besancon, France)
Lecturer:	Dr M. Harris: BSc. (UNAM), MSc. (China University of Geosciences Beijing, China), PhD (UNAM)
Lecturer:	Ms E. Shalimba: BSc.Hons. (UNAM), MSc. (China University of Geosciences Beijing, China)

Lecturer:	Dr C. Uahengo: BSc. (UNAM), MSc. (China University of Geosciences Beijing, China); PhD (China University of Geosciences Beijing, China)
Lecturer:	Ms A. Nakwafila BSc. Hons. (UNAM), MSc. (Stellenbosch, South Africa) (on study leave)
Tutor	Mr. M. Tshiningayamwe: BSc. Hons (UNAM); (on study leave)
Tutor:	Mr J.T. Shilunga: BSc.Hons. (UNAM), MSc. (Witwatersrand, South Africa) (on study leave)
Technologist:	Ms J. Kaluwapa: Nat. Dipl. (Mech. Eng.), (NUST) B.A. Hons. (UNAM)
Assistant Lecturer	Ms M. Shaale: BSc. Hons (UNAM), MSc (
Technologist:	Mr G. Nghikongelwa: Nat. Dipl. (Mech. Eng.), B.Tech, NUST

DEPARTMENT OF WILDLIFE MANAGEMENT AND TOURISM STUDIES

☎(+264 66) 066 2626000 🖷(+264 066 2626000 **esimasiku@unam.na**✉ Private Bag 1096, Katima Mulilo, Ngweze, Namibia

Head of Department:	Dr Evans Simasiku
Associate Professor:	**Vacant**
Senior Lecturer:	Dr E Klingelhoeffer: PhD – Oceanography/Fish Stock Assessment: University of Port Elizabeth (UPE) - Nelson Mandela Metropoliten University, South Africa; Master of Science (MSc) – Terrestrial Ecology/Wildlife Management (University of Pretoria), South Africa; Bachelor of Science Honours (BSc Hon) in Wildlife Management (University of Pretoria, South Africa); Bachelor of Science (BSc) with major in Zoology and Botany: University of Port Elizabeth (UPE) – South Africa; Tertiary Education Diploma (major in Androgocics and Gerongocis) – University of South Africa (UNISA), South Africa.
Senior Lecturer:	Dr E F Chimbioputo : B.Sc. - Environmental Biology and Computer Science (UNAM); M Sc – Protected Area Management (University of KwaZulu-Natal (KZN); PhD – Population Genetics – Pontificia Catholic University of Rio Grande do Sul (PUCRS), Brazil
Senior Lecturer:	Dr E Simasiku: MSc Fisheries Ichthyology (Rhodes University) (2014); BSc Hon. Zoology (UCT); BSc Fisheries and Aquatic Science (UNAM), PhD. Biological scinces (UNAM) (2020).
Lecturer:	Mr. J Kairu: MSc Natural Resource Management (1991)- Agricultural University of Norway (AUN); PGD (1990) Management of Natural Resources and Sustainable Agriculture (AUN); BSc (Wildlife Management) (1988) Moi University; Diploma (Wildlife Management) (1977)CAWM
Lecturer:	Dr. J Nakanyala: BA (UNAM), MA (UNAM), Ph.D (UNAM).
Lecturer:	Mr. M S Lukubwe: MSc Geographical Information Science and Systems (2014); University Of Salzburg, Austria; BA Tourism – University of Namibia (2007)
Lecturer:	Ms. S N Kosmas: MSc Environmental and Resource Management – Brandenburg (Univeristy of Technology), Cottbus, Germany (2013); BSc Fisheries and Aquatic Sciences, (University of Namibia) (2011)
Lecturer:	Dr. L Rutina: BSc Agriculture (University of Botswana); MSc Conservation Biology (University of Kent, UK) & PhD (Norwegian University of Life Sciences, Norway).
Lecturer:	Ms. Ellen Kimaro, BSc + Msc (Varna University)
Lecturer:	Mr. Jona Heita, BA in Tourism (UNAM), Postgraduate Diploma in Education (PGDE), MA in Culture and Environment in Africa (CEA) (University of Cologne, Germany).
Senior technologist	Ms. Eva Kasinda BSc (Hons) Environmental Biology & Geology, UNAM. Masters of Natural Resources Management (NUST).
Technologist	Mr. Johannes Hamutenya BSc (Hons) Integrated Environmental Science, UNAM; Diploma in Agriculture, UNAM.

B. QUALIFICATIONS OFFERED BY THE FACULTY

The Faculty may award the following Undergraduate and Postgraduate degrees:

B.1.UNDERGRADUATE AND POSTGRADUATE PROGRAMMES

B.1.1 BIOCHEMISTRY, MICROBIOLOGY, & BIOTECHNOLOGY DEPARTMENT

CODE	DEGREE	MINIMUM DURATION
11BCAC	Bachelor of Science in Applied Biochemistry Honours Biomedical	4 years full-time
11BCAB	Bachelor of Science in Applied Biochemistry Honours Environmental	4 years full-time
11BMBL	Bachelor of Science in Microbiology Honours	4 years full-time
11BSAB	Bachelor of Science in Biochemistry Honours	1 year full-time
11BMBA	Bachelor of Science in Microbiology Honours	1 year full-time
POSTGRADUATE PROGRAMME		
11MSIB	Master of Science in Industrial Biochemistry	2 years full-time
11MMBL	Master of Science Microbiology	2 years full-time
11MASC	Master of Science (by Thesis only)	2 years full-time
11DPSC	Doctor of Philosophy	3 years full-time

B.1.2 DEPARTMENT OF ENVIRONMENTAL SCIENCES CODE

	DEGREE	MINIMUM DURATION
17HDNR	Diploma in Natural Resources Management	3 years full-time
11BMBL	Bachelor of Science in Environmental Biology (Honours)	4 years full-time
17BSIE	Bachelor of Science in Integrated Environmental Science (Honours)	4 years full-time
13BGIS	Bachelor of Science in Geo-Information Science (Honours) **(Specialization: Geography and Environmental Studies or Biology)**	4 years full-time
11BEBA	Bachelor of Science in Environmental Biology (Honours) - (Articulation)	1 year full-time
POSTGRADUATE PROGRAMME		
11 MSCE	Master of Science in Biodiversity Management	2 years full-time
11MASC	Master of Science (by Thesis only)	2 years full-time
11DPSC	Doctor of Philosophy	3 years full-time

B.1.3 COMPUTER, MATHEMATICAL & STATISTICAL SCIENCE

CODE	DIPLOMA/DEGREE	MINIMUM DURATION
11BSCM	Bachelor of Science in Mathematics Honours-Physics	4 years full-time
11BSMC	Bachelor of Science in Mathematics Honours-Computer Science	4 years full-time
11BSMS	Bachelor of Science in Mathematics Honours-Statistics	4 years full-time
11BFMA	Bachelor of Science in Financial Mathematics Honours	4 years full-time
22BSCO	Bachelor of Science in Computer Science Honours	4 years full-time
22BSIT	Bachelor of Science in Information Technology Honours	4 years full-time
11BSCS	Bachelor of Science in Statistics Honours	4 years full-time
11BSPO	Bachelor of Science in Population Studies Honours	4 years full-time
22DCMP	Diploma in Computer Science **(OSHAKATI CAMPUS)**	2 years full-time
11BSMA	Bachelor of Science in Mathematics Honours	1 year full-time
11BSSA	Bachelor of Science in Statistics Honours	1 year full-time
11BSAP	Bachelor of Science in Population Studies Honours	1 year full-time
22BSCT	Bachelor of Science in Computer Science Honours	1 year full-time
POSTGRADUATE PROGRAMME		
11MSCM	Master of Science Mathematics	2 years full-time
11MASC	Master of Science (by Thesis only)	2 years full-time
22MSCI	Master of Science Information Technology	2 years full-time
22MASC	Master of Science (by Thesis only)	2 years full-time
11MASC	Master of Science (by Thesis only)	2 years full-time
11MSSB	Master of Science Biostatistics	2 years full-time
11MSST	Master of Science Applied Statistics and Demography	2 years full-time
11DPSC	PhD in Applied Statistics	3 years full-time
11DPSC	Doctor of Philosophy (by Thesis only)	3 years full-time
11DPSC	PhD in Population Studies	3 years full-time
22DPSC	Doctor of Philosophy	3 years full-time

B.1.4 GEO-SCIENCE DEPARTMENT

CODE	DEGREE	MINIMUM DURATION
11BSCG	Bachelor of Science in Geology Honours	4 years full-time
11BSGA	Bachelor of Science in Geology Honours	1 year full-time
POSTGRADUATE PROGRAMME		
11MSGL	Master of Science in Applied Geology	2 years full-time
11MSPG	Master of Science in Petroleum Geology	2 years full-time
11MASC	Master of Science (by Thesis only)	2 years full-time
11DPSC	Doctor of Philosophy	3 years full-time

B.1.5 PHYSICS, CHEMISTRY & MATERIAL SCIENCE DEPARTMENT

CODE	DEGREE	MINIMUM DURATION
11BPHY	Bachelor of Science in Physics Honours A1: Mathematics slant	4 years full-time
11BPCO	Bachelor of Science in Physics Honours A2: Computer Science slant	4 years full-time
11BPCH	Bachelor of Science in Physics Honours C: Chemistry	4 years full-time
11BSCC	Bachelor of Science in Chemistry Honours Medicinal	4 years full-time
11BSEC	Bachelor of Science in Chemistry Honours Environmental	4 years full-time
11BSGC	Bachelor of Science in Chemistry Honours Geochemistry	4 years full-time
11BSAC	Bachelor of Science in Chemistry Honours	4 years full-time
11BSPA	Bachelor of Science in Physics Honours **(Articulation)**	1 year full-time
11BSAC	Bachelor of Science in Chemistry Honours **(Articulation)**	1 year full-time

POSTGRADUATE PROGRAMME

11MSPH	Master of Science Physics	2 years full-time
11MSCC	Master of Science Chemistry	2 years full-time
11MSRM	Master of Science in Renewable Energy Materials	2 years full-time
11MSRP	Master of Science in Renewable Energy Photovoltaics	2 years full-time
11MSNU	Master of Science in Nuclear Science (not on offer in 2022)	2 years full-time
11MASC	Master of Science (by Thesis only) (only Chemistry)	2 years full-time
11DPSC	Doctor of Philosophy	3 years full-time

B.1.6 DEPARTMENT OF WILDLIFE MANGENT AND TOURISM STUDIES

	DEGREE	MINIMUM DURATION
17BSWM	Bachelor of Science in Wildlife Management & Ecotourism (Hons)	4 years full-time
13BATM	Bachelor of Arts in Tourism Management (Hons)	4 years full-time
13BTHS	Bachelor of Art in Tourism: Heritage Studies (Hons)	4 years full-time

POSTGRADUATE PROGRAMME

11MSIB	Master of Science in Wildlife Management & Ecotourism	2 years full-time
11DPSC	Doctor of Philosophy	3 years -time

C. GENERAL REGULATION PERTAINING TO UNDERGRADUATE STUDIES

C.1. DURATION OF STUDY

All Bachelor of Science Honours degree programmes cannot be completed in less than four (4) years. All Bachelor of Science Honours degrees must be completed within six (6) years of full-time study, unless special permission is granted for this period to be exceeded.

C.2. TWO MODES OF STUDY FOR FIRST YEAR MATHEMATICS NO LONGER ON OFFER IN 2020

All students will not be able to register for the Slow Mode Mathematics modules in 2020 as this has now been discontinued.

C.3. EXEMPTIONS

UNAM will give exemptions for equivalent courses taken at other tertiary institutions but the exemptions shall not exceed 50% of the programme of the Bachelor of Science degree. See the General Information & Regulations Prospectus and Fees Prospectus.

C.4. CLASS ATTENDANCE

In order to be admitted to examinations, students are required to attend at least **80%** of the lectures and to complete the required elements that make up the continuous assessment mark. Refer to the **General Inf**or**mation and Regulations Prospectus**.

C.5. PRACTICALS

Attendance of practical sessions is compulsory.

C.6. CURRICULUM

C.6.1. COURSES, CREDITS AND CONTACT HOURS

One contact hour is equivalent to one **(1)** lecture period on the timetable of the Faculty of Science.
A **full semester course** carries **16** credits and is taught at four **(4)** contact hours per week over one semester, i.e. **56** contact hours per semester.
A **half –course** carries **8** credits and is taught at two **(2)** contact hours per week over one semester, i.e. 28 contact hours per semester.
A **double-course** carries **32** credits and extends over one academic year at four (**4**) periods per week and terminates in an examination at the end of the year. (For the composition of a curriculum a double module is regarded as equal to two courses)
Refer to the relevant programmes (to determine the credits and contact hours of any particular course).

C.6.2. CURRICULUM COMPILATION

To be awarded a Bachelor's degree by the Faculty, a student must pass all the courses prescribed for each curriculum combination. In the BSc Honours degree programme a student maybe required to select the courses offered by a specific department, in accordance with Faculty and department regulations.

C.6.3. STUDENT REGISTRATION

C.6.3.1. UNIVERSITY CORE CURRICULUM

All students will take the equivalent of four (4) courses (48 credits) in the **University Core Curriculum** in the first year of study as part of their curriculum.

All students register for the following two (2) half-courses:

SEMESTER	CODE	COURSE NAME
1&2	CSI3580	Contemporary Social Issues (half-course)
1	CLC3509	Computer Literacy (half-course)

Students furthermore add the equivalent of **two (2)** full English courses from the **University Core Curriculum** to their curriculum according to the following rules:

Students with any one of the following qualifications in English will apply to be **credited/exempted** for **LCE3419 English Communication and Study Skills** and will register for the course below: (a) a pass (minimum grade 4) in English First Language at NSSC Higher Level or the equivalent; (b) grade 1, 2 or 3 in English Second Language at NSSC Higher Level or the equivalent.

SEMESTER	CODE	COURSE NAME
1	LCE3419	English Communication and Study Skills
2	LEA3519	English for Academic Purposes

Students with a D symbol in English Second Language at NSSC Ordinary Level, or the equivalent, register for only the double-coursebelow:

SEMESTER	CODE	COURSE NAME
1 & 2	LEG 2410	English for General Communication (double-course)

LEG2410 ENGLISH FOR GENERAL COMMUNICATION

Course title: **English for General Communication**
Code: **LEG2410**
NQF Level: 4
Contact hours: 4 hours per week for two semesters
Credits: 32
Course Assessment: Continuous assessment (**60%**):4 reading tests, 4 writing tests, 2 oral presentations and 1 literature worksheet. 1x3 hour examination paper (**40%**):
Pre-requisites: None
Course description: This course attempts to assist students to improve their general English proficiency. The main goal of this course is to develop the reading, writing, listening, speaking and study skills of students in order for them to perform tasks in an academic environment and beyond.

C.6.3.2. UNIVERSITY CORE CURRICULUM COURSE DESCRIPTIONS

LCE3419 ENGLISH COMMUNICATION & STUDY SKILLS

Course title: **ENGLISH COMMUNICATION AND STUDY SKILLS**
Code: **LCE3419**
NQF Level: 4
Contact hours: 4 hours per week for one semester
Credits: 16
Course Assessment: Continuous assessment (60%): two tests (reading and writing), two reading assignments, one oral presentation Examination (40%): one three hour examination paper
Pre-requisites: None
Course description: This course is aimed at assisting students in the development of their reading, writing and speaking and listening skills, in order to cope with studying in a new academic environment and in a language which may not be their first language. The course also focuses on study skills that students need throughout their academic careers and beyond. The course serves as an introduction to university level academics, where styles of teaching and learning differ from those at secondary schools in that more responsibility is placed on the student. The course therefore, focuses on the skills that students need throughout their academic careers and beyond.

LEA3519 ENGLISH FOR ACADEMIC PURPOSES

Course title:	**ENGLISH FOR ACADEMIC PURPOSES**
Code:	**LEA3519**
NQF level:	5
Contact hours:	4 periods per week for one semester
Credits:	16
Course assessment:	Continuous assessment (**60%**): 2 tests (reading and writing), 1 academic written essay, 1 oral presentation Examination **(40%)**: One three hour examination paper
Prerequisites:	None

Course description: This course develops a student's understanding, and competencies regarding academic conventions such as academic reading, writing, listening and oral presentation skills for academic purposes. Students are required to produce a referenced and researched essay written in formal academic style within the context of their university studies. Students are also required to do oral presentations based on their essays. The reading component of the course deals with academic level texts. This involves students in a detailed critical analysis of such texts. The main aim is therefore, to develop academic literacy in English.

CLC3509 COMPUTER LITERACY

Course title:	**COMPUTER LITERACY**
Code:	**CLC3509**
NQF level:	4
Contact hours:	1 lecture theory and 1 lecture practical per week for one semester
Credits:	8
Course assessment:	Continuous Assessment **100%**: 2 Practical Tests **50%**, 2 Theory Tests **50%**
Prerequisites:	None

Course description: The aim of this course is to equip the students through hands-on experience with the necessary skills to use application software: word processing, spreadsheets, databases, presentations and communications. The objective is to increase student's productivity in both the education and later, the work environment.

Content: The course covers the following topics. Introduction to Computers: hardware and software, types and categories of computers, usage of Computer devices and peripherals. Working with the windows operating system: File Management, working with multiple programs, using the recycle bin. Using a word processor: formatting a text and documents, spelling check, grammar and thesaurus tools, inserting tables, auto-shapes, clip arts, charts, and mail merge. Spreadsheet: worksheets and workbooks, ranges, formulas and functions, creating graphs, charts, and printing the workbook. Databases: creating tables, relationships, queries, forms and reports. Presentation software: slide layout and master, animations, auto-content wizard and templates. Communication tools: introduction to the Internet, web browsers, search engines, downloading and uploading files, creating and sending messages, email etiquette, internet security, and digital signatures.

CONTEMPORARY SOCIAL ISSUES CSI3580

Note: This module will only be offered online as from 2018

NQF:	5
Credits:	8
Continuous assessment:	Continuous Assessment **100%**: Quizzes, Tests, Moodle Assignments, Journal Entries, Reflections, Service and Experiential Learning Projects
Prerequisite:	None

Course Content: The module is designed to encourage behavioural change among UNAM students and inculcate the primacy of moral reasoning in their social relations and their academic lives. In providing students with critical and analytical thinking the module enables students to grow and develop into well rounded citizens, capable of solving contemporary social challenges experienced in their communities and societies. The teaching of the module takes three dimensions: the intellectual, the professional and the personal dimensions. The intellectual dimension is fostered through engaging students with subject knowledge, independent learning and module assessment. The professional dimension, on the other hand, is fostered through exposing students to real life situations of case studies and practical exercises that draws attention to social issues that attract on-going political, public and media attention and/or debate.

C.6.3.3. FACULTY CORE CURRICULUM

All students must register for the following **two (2)** full courses **(32 credits)**:

MAT3511 Basic Mathematics
MAT3512 Precalculus

C.6.3.4. FACULTY CORE CURRICULUM COURSE DESCRIPTIONS

MAT3511 BASIC MATHEMATICS

Course Code	**MAT3511**
NQF Level	5
Notional Hours	160
NQF Credits	16
Prerequisite	None
Contact Hours	4 lectures plus 2 tutorials per week for one semester

Course Assessment: Continuous Assessment: **50%** (minimum of 3 class tests). Examination: **50%** (1 x 3-hour paper).

Course description: Algebraic expressions: Simplification, expansion, factorization, polynomials, remainder and factor theorem, quadratic polynomial. Binomial expansions, Pascal's triangle and the Binomial Theorem.Rational expressions, partial fractions. **Equations and inequalities:** Linear equations in one-variable, simultaneous linear equations, quadratic equations, simultaneous non-linear equations. Linear inequalities, non-linear inequalities.**Sets:** What is a set? Set notation, equality of sets, subsets, characterization of equality via the subset relation, empty set, power sets, Venn diagrams, intersection, union, complement, de Morgan's laws, set difference, symmetric difference, proofs of *simple results* on set equality. Standard examples of sets: natural numbers, integers, rationals, real numbers. Absolute value, intervals in R. A bit about cardinality of sets (examples of finite, *infinite, countable, uncountable sets)*. **Trigonometry:** Trigonometric ratios, angle orientation in the *xy*-plane, graphs of trigonometric functions , trigonometric identities, justifying (proving) equality of relatively simple trigonometric expressions. Sum/difference, double angle, half angle and sum to product formulas. **Sequences:** Definition, notation, obtaining the general term in sequences, arithmetic sequences, geometric sequences, recursively defined sequences.

MAT3512 PRECALCULUS

Course Code	**MAT3512**
NQF Level	5
Notional Hours	160
NQF Credits	16
Prerequisite	None
Contact Hours	**4** lectures plus **1 x 2 hour** tutorial per week for one semester

Course Assessment: Continuous Assessment: 50% (minimum of **3** class tests). Examination: 50% (1 x 3-hour paper).

Course description: Functions: one-to-one, onto and bijective functions, horizontal line test, inverse of a function. **Combinations of functions:** composition of functions, sum, difference, quotient of functions and their domains. Polynomial functions, rational functions and their graphs. Introduction of exponential and logarithmic functions.Trigonometric functions and their graphs, inverse trigonometric functions, trigonometric equations. **Limit of a function:** definition, left and right limits, improper limits, continuity in terms of limits. **Differentiation:** rate of change, derivative of a function, rules of differentiation, derivatives of polynomial and rational functions, increasing and decreasing functions and graph sketching. **Integration:** Antiderivatives (polynomial functions and rational exponents), the definite integral, area under a graph.

C.7. EXAMINATION REGULATIONS

For detailed examination and promotion rules see the General Information & Regulations Prospectus. A candidate will be eligible to write the examination if he/she has obtained the required continuous assessment mark of 40%. Examination will be administered at the end of each semester.

C.8. RE-ADMISSION INTO THE FACULTY OF SCIENCE

A student will not be re-admitted into the Faculty if he/she has not passed the required courses to be re-admitted

C.9. PASS REQUIREMENTS

In all cases, prerequisites for courses have to be passed before a student can proceed to register for courses that require prerequisites.

- All **first year** courses must be passed before one can register for **third year** courses.
- All **second year** courses must be passed before one can register for **fourth year** courses

C.10. MAXIMUM NUMBER OF COURSES PER YEAR

No student will be allowed to register for more than **12** courses per year

C.11. COURSE RESTRICTIONS

A student will be admitted to a specific course only if he/she meets the requirements for the particular course. The **UNAM CORE**, as well as **MAT3511 Basic Mathematics** and **MAT3512 Precalculus** are compulsory for all **first year** B.Sc. Honours degree students, including all students from other Faculties who wish to major in a subject offered by the Faculty of Science.

D. DEPARTMENT OF BIOCHEMISTRY, MICROBIOLOGY AND BIOTECHNOLOGY

D.1. DEPARTMENTAL REGULATIONS

D.1.1. PURPOSE AND RATIONALE OF THE QUALIFICATIONS

The purpose of these qualifications is to provide students with an all-round view between the disciplines of Biochemistry, Microbiology and other related fields. The Bachelor of Science in Biochemistry (Honours) with Biomedical Applications and the Bachelor of Science in Microbiology (Honours) are pure academic/science programs and our graduates are not limited to a specific profession. Graduates of these degrees have indefinite employment opportunities in various industries in Namibia and beyond. Outstandingly, employers value the scientific, analytical and problem-solving skills possessed by our biochemistry and microbiology graduates.

Biochemistry, sometimes called biological chemistry, is the study of the structure, composition, and chemical reactions of substances in living systems. It is a branch of science that covers the application of Chemical techniques and knowledge in living organisms. It provides a bridge between chemistry and various scientific disciplines including genetics, microbiology, forensics, plant sciences and medicine. The understanding of chemical processes at molecular level (metabolic processes) is achieved through Biochemistry. The advances in the field of Biochemistry over the past 100 years have been staggering. It is through Biochemistry that molecular targets of diseases are identified and potential drug agents are developed. Understanding how diseases affect the metabolic function in living organisms, value addition of natural and synthetic products for applications in health, food and cosmetics industries. Topics include how living things obtain energy from food, the chemical basis of heredity, industrial application of biochemistry, drug design and development, biotechnology, micro-and nanotechnology and what fundamental changes occur in disease. Students will get the opportunity to apply biochemistry knowledge in food science, pharmacology, physiology, microbiology, and clinical chemistry. Enzymes and their kinetics and mechanisms are covered in detail. Metabolic pathways are examined from thermodynamic and regulatory perspectives.

Microbiology is useful in health, agriculture, food, soil, water, environmental, industrial, pharmaceutical, and biotechnological sectors. In Namibia, as in many other countries worldwide, Microbiology graduates work at the cutting-edge of national programmes and tipping point of international efforts to prevent and control diseases, increase food crop and livestock production, augment soil fertility, provide clean drinking water, remedy environmental pollution, and synthesize metabolites with industrial, food, pharmaceutical and biotechnological applications and value. Topics covered are such as bioenergetics, molecular biology, industrial application of microbiology, biotechnology, immunology, and epidemiology. Students will get the opportunity to apply microbiology knowledge to health, food science, and biotechnology, and agriculture, industrial and environmental microbiology.

The department seeks to facilitate students' progression towards fulfilling and exciting careers in academia, industry, and/or government and also to develop their skills as future leaders in science and society. Successful candidates can be successful entrepreneurs or take employment in the education, public or private sectors especially in fields like, food and beverage Industries, forensics, agriculture, environmental, academic institutions, scientific research institutions , etc, where a balanced Biochemistry/Microbiology knowledge is important.

D.1.2. ADMISSION REQUIREMENTS

To register for the Bachelor of Science in Biochemistry (Honours) degree programmes or a Bachelor of Science in Microbiology (Honours) degree programme, a candidate must hold a valid Namibian Senior Secondary Certificate (NSSC) (ordinary or higher) or a recognised equivalent qualification. English is a compulsory subject and should normally have been obtained as a Second Language at NSSC (O level) with a minimum C symbol or English as a First Language at NSSC (O level) with a minimum D symbol. In addition, at least a C symbol on NSSC or equivalent qualification in Biology, Mathematics and Physical Science is required. A candidate should obtain a minimum of 25 points on the UNAM Evaluation Point Scale in his/her five (5) best subjects (of which Mathematics, English, Physical Science and Biology must be included) to be admitted to undergraduate studies (Refer to the General Admission Criteria for Undergraduate Programmes in the General Information and Regulations Yearbook). Obtaining the minimum number of points, however, does not necessarily ensure admission. Admission is based on availability of places and is awarded on the basis of merit.
The Faculty reserves the right to subject candidates to additional selection procedures before admission. Admission can also be considered for persons who qualify through the **Mature Age Entry Scheme** upon successful completion of the relevant examinations as set out in the General Regulations (in the General Information and Regulations Yearbook). A special application form is available for this purpose. Such candidates may also be required to pass a Faculty entry test before admission is considered.

D.1.3. ASSESSMENT CRITERIA

All practical sessions are compulsory. Tutorial sessions are compulsory in the courses where they are offered. To qualify for the supplementary examination, the student needs a final mark of between **45 – 49%**, and a subminimum of **40%** examination mark. In their final year, all students are required to do a research project.

- BSc Biochemistry (Honours) degree programmes: the final mark is composed of **50%** continuous assessment mark and **50%** examination mark.

Microbiology Honours degree program: the final mark is composed of 40% continuous assessment mark and 60% examination mark, unless otherwise indicated in the specific module descriptor.

D.1.4. MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE FACULTY

Minimum requirements for readmission into the School of Science
To be readmitted to the School of Science for a particular year of registration, a student must have passed the minimum number of courses required as indicated below:
• **64** credits of total **160** credits by the end of the first year (about 40%); 2 of these courses (equivalent to **32** credits) must be **non-core**
• **8** full courses (equivalent to **128** credits of **288** cumulative credits) by the end of the **second year** (about 45%)
• **15** full courses (equivalent to **240** credits of **424** cumulative credits) by the end of the **third year** (about 57%)
• **24** full courses (equivalent to **384** credits of **544** cumulative credits) by the end of the **fourth year** (about 69%)

D.1.5. ADVANCEMENT AND PROGRESSION RULES

A student advances to the following academic level of study when at least 2/3 of the courses of the curriculum for a specific year have been passed. If a student passed only 1/3 of the full curriculum of a specific year, he/she may not register for any courses of the following year. In all cases, prerequisites for courses have to be passed before a student can proceed to register for courses.

- **From year 1 to year 2:** At least **7** full courses (equivalent to **112** credits of **160** credits at level **5**) prescribed for year **1**.
- **From year 2 to year 3:** All first year courses plus at least **5** full courses (equivalent to **80** credits of **128** credits at level **6**).
- **From year 3 to year 4:** All second year courses plus at least **5** full courses (equivalent to **80** credits of **128** credits at level **7**).

D.1.6. REQUIREMENTS FOR QUALIFICATION AWARD

To be awarded a Bachelor's degree Honours by the Faculty, a student must pass all the courses prescribed in each respective programme including the electives. To be awarded with a qualification degree, students enrolled for either BSc in Biochemistry (Honours) with Biomedical Applications or the BSc in Microbiology (Honours) programmes, should obtain a total number of 544 credits respectively. To be awarded with a qualification degree, students enrolled for BSc Biochemistry (Honours) with Environmental Applications should obtain a total number of 528 credits.

D.1.10. BACHELOR OF SCIENCE IN BIOCHEMISTRY (HONOURS) WITH BIOMEDICAL APPLICATION: 11BCAC

QUALIFICATION: BSC IN BIOCHEMISTRY (HONOURS) 11BCAC
Students opting for a BIOMEDICAL application must take all of the following courses:

YEAR 1

COURSE CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITE	CO-REQUISITE
Year 1 Semester 1					
CHM3511	Chemistry 1A	5	16	None	None
MAT3511	Basic Mathematics	5	16	None	None
LCE3419	English Communication and Study Skills	5	16	None	None
PHY3501	Physics for Life Sciences 1	5	8	None	None
CLC3509	Computer Literacy	5	8	None	None
BLG3511	Introduction to Biology	5	16	None	None
Year 1 Semester 2					
CHM3512	Chemistry 1B	5	16	None	CHM3511
MAT3512	Precalculus	5	16	None	None
LEA3519	English for Academic Purposes	5	16	None	None
CSI3580	Contemporary Social Issues	5	8	None	None
STS3522	Introduction to Statistics	5	8	None	None
BLG3512	Diversity of Life	5	16	None	None
Total credits			**160**		

YEAR 2

COURSE CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITE	CO-REQUISITE
Year 2 Semester 1					
CHM3611	Inorganic Chemistry I	6	16	CHM3511, CHM3512	None
CHM3631	Physical Chemistry I	6	16	CHM3511, CHM3512 MAT3511, MAT3512	None
CHM3651	Organic Chemistry I	6	16	CHM3511, CHM3512	None
MAT3611	Calculus I	6	16	MAT3512	None
STS3621	Statistics for Life Sciences I	6	8	STS3522	None
Year 2 Semester 2					
CHB3632	Biomolecules and Catalysis	6	16	CHM3511 CHM3512	CHM3651
MBL3632	Introduction to microbiology	6	16	BLG3511 BLG3512	None
CHM3602	Analytical Chemistry I	6	8	CHM3511; CHM3512	None
Total credits			**112**		

YEAR 3

COURSE CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITE	CO-REQUISITE
Year 3 Semester 1					
CHB3731	Bioenergetics and Metabolism		16	CHB3632	None
CHB3741	Biochemical Analysis		8	CHB3632	None
CHM3721	Analytical Chemistry II		8	CHM3602	None
MBG3711	Microbial Genetics		16	MBL3632	None
CHP3721	Drug Discovery and Development		8	CHM3651	None
CHP3741	Medicinal Chemistry I		8	CHM3651;	CHP3721
Year 3 Semester 2					
CHB3722	Transmission of Genetic Information		8	CHB3632	None
CHM3752	Organic Chemistry II		16	CHM3651	none
CHM3702	Instrumental Analysis I		8	CHM3602,CHM3651	none
CHM3712	Physical Chemistry II		16	CHM 3631, MAT3611	none
CHM3722	Research Methodology		8	**Pass all 2nd year Chemistry & Biochemistry courses**	none
CHB3762	Innovation and Entrepreneurship		8	CHP3721, CHB3741	none
CHB3742	Biosafety, Bioethics and Intellectual property Rights (IPR)		8	none	CHB3731
Total credits			**136**		

YEAR 4

COURSE CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITE	CO-REQUISITE
Year 4 Semester 1					
CHB3831	Bioinformatics	8	16	CHB3711, MBL3631	None
CHM3801	Instrumental Analysis II	8	8	CHM3702	None
CHM3821	Natural Product Chemistry I	8	8	CHM3752,CHM3702	None
CHM3811	Organic Chemistry III	8	16	CHM3752	None
CHC3821	Clinical Biochemistry	8	8	CHB3731	None
Year 4 Semester 2					
CHB3842	Biotechnology, Micro and Nanotechnology	8	8	CHB3722	None
CHB3862	Industrial Pharmaceutical Biotechnology	8	8	CHB3722, CHP3721	None
CHM3822	Natural Product Chemistry II	8	8	CHM3752	CHM3801
CHP3842	Medicinal Chemistry II	8	8	CHP3741, CHP3721	CHM3811
MIC3862	Medical Bacteriology	8	8	MBG3711	None
CHN3842	Health and Nutritional Biochemistry	8	8	CHB3731, CHP3741	None
CHM3810	Research Project	8	32	**Pass in all third year biochemistry courses**	None
Total credits			**136**		

D.1.11. BACHELOR OF SCIENCE IN BIOCHEMISTRY (HONOURS) WITH ENVIRONMENTAL APPLICATION: 11BCAB

QUALIFICATION: BSC IN BIOCHEMISTRY (HONOURS) 11BCAB

Students opting for an ENVIRONMENTAL application must take all of the following courses:

YEAR 1

COURSE CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITE	CO-REQUISITE
Year 1 Semester 1					
CHM3511	Chemistry 1A	5	16	None	None
MAT3511	Basic Mathematics	5	16	None	None
LCE3419	English Communication and Study Skills	5	16	None	None
PHY3501	Physics for Life Sciences 1	5	8	None	None
CLC3509	Computer Literacy	5	8	None	None
BLG3511	Introduction to Biology	5	16	None	None
Year 1 Semester 2					
CHM3512	Chemistry 1B	5	16	None	CHM3511
MAT3512	Precalculus	5	16	None	None
LEA3519	English for Academic Purposes	5	16	None	None
STS3522	Introduction to Statistics	5	8	None	None
BLG3512	Diversity of Life	5	16	None	None
CSI3580	Contemporary Social Issues	5	8	None	None
Total credits			**160**		

YEAR 2

COURSE CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITE	CO-REQUISITE
Year 2 Semester 1					
CHM3611	Inorganic Chemistry I	6	16	CHM3511, CHM 3512	None
CHM3631	Physical Chemistry I	6	16	CHM3511, CHM3512 MAT3511, MAT3512	None
CHM3651	Organic Chemistry I	6	16	CHM3511, CHM3512	None
MAT3611	Calculus I	6	16	MAT3512	None
STS3621	Statistics for Life Sciences I	6	8	STS3522	None
CHP3621	Radiochemistry	6	8	CHM3511 CHM3512	None
Year 2 Semester 2					
CHB3632	Biomolecules and Catalysis	6	16	CHM3511 CHM3512	CHM3651
MBL3632	Introduction to microbiology	6	16	BLG3511 BLG3512	None
CHM3602	Analytical Chemistry I	6	8	CHM3511; CHM3512	None
Total credits			**120**		

YEAR 3

COURSE CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITE	CO-REQUISITE
Year 3 Semester 1					
CHB3731	Bioenergetics and Metabolism	7	16	CHB3632	None
CHB3741	Biochemical Analysis	7	8	CHB3632	None
CHM3721	Analytical Chemistry II	7	8	CHM3602	None
MBG3711	Microbial Genetics	7	16	MBL3632	None
CHP3701	Water Analysis	7	8	CHM3602	None
CHP3711	Environmental Chemistry I	7	16	CHP3621	None
Year 3 Semester 2					
CHB3722	Transmission of Genetic Information	7	8	CHB3632	None
CHM3752	Organic Chemistry II	7	16	CHM3651	None
CHM3702	Instrumental Analysis I	7	8	CHM3602 CHM3651	None
CHM3712	Physical Chemistry II	7	16	CHM 3631, MAT3611	None
CHB3762	Innovation and Entrepreneurship	7	8	CHP3721, CHB3741	None
CHM3722	Research Methodology	7	8	**Pass in all second year Chemistry and Biochemistry courses**	None
Total credits			**136**		

YEAR 4

COURSE CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITE	CO-REQUISITE
Year 4 Semester 1					
CHB3831	Bioinformatics for Biochemistry	8	16	CHB3722	None
CHM3801	Instrumental Analysis II	8	8	CHM3702	None
CHP3811	Wastewater Treatment	8	16	CHP3701, CHP3711	None
Year 4 Semester 2					
CHP3822	Environmental Chemistry II	8	8	CHP3711	None
CHB3842	Biotechnology, Micro and Nanotechnology	8	8	CHB3722	None
CHB3862	Industrial Pharmaceutical Biotechnology	8	8	CHB3722, CHP3721	None
CHC3832	Chemical Xenobiotics and Toxicology	8	16	CHP3711, CHP3701	None
CHM3810	Research Project	8	32	**Pass in all third year courses**	None
Total credits			**120**		

D.1.12. BACHELOR OF SCIENCE IN MICROBIOLOGY (HONOURS)

QUALIFICATION: B.Sc. in Microbiology (Honours) 11BMBL

YEAR 1

COURSE CODE	COURSE NAME	NQF Level	CREDIT	PRE-REQUISITE	CO-REQUISITES
Year 1 Semester 1					
MAT3511	Basic Mathematics	5	16	None	None
CLC3509	Computer Literacy	5	8	None	None
LCE3419	English Communication & Study Skills	5	16	None	None
BLG3511	Introduction to Biology	5	16	None	None
CHM3511	Chemistry 1A	5	16	None	None
PHY3501	Physics for Life Sciences	5	8	None	None
Year 1 Semester 2					
MAT3512	Pre-Calculus	5	16	None	None
LEA3519	English for Academic Purposes	5	16	None	None
STS3522	Introduction to Statistics	5	8	None	None
CHM3512	Chemistry 1 B	5	16	None	CHM3511
BLG3512	Diversity of Life	5	16	None	None
CSI3580	Contemporary Social Issues	5	8	None	None
Total Credits				**160**	

YEAR 2

COURSE CODE	COURSE NAME	NQF Level	CREDIT	PRE-REQUISITES	CO-REQUISITES
	Year 2 Semester 1				
BLG3611	Animal Form and Function	6	**16**	BLG3512, BLG3511	None
MBL3631	Cell Molecular Biology & Genetics	6	**16**	BLG3511&BLG3512,	None
BLG3621	Biometrics I	6	**8**	STS3522	BLG3622
MBL3611	Microbial Systematics	6	**16**	BLG3512	MBL3632
CHM3651	Organic Chemistry I	6	**16**	CHM3511&CHM3512	None
	Year 2 Semester 2				
BLG3612	Plant Form and Function	6	**16**	BLG3511&BLG3512	None
MBL3632	Introduction to Microbiology	6	**16**	BLG3511&BLG3512	MBL3611
BLG3622	Biometrics II	6	**8**	STS3522	BLG3621
CHB3632	Biomolecules and Catalysis	6	**16**	CHM3511&CHM3512	CHM3651
Total Credits			**128**		

YEAR 3

COURSE CODE	COURSE NAME	NQF Level	CREDIT	PRE-REQUISITES	CO-REQUISITES
	Year 3 Semester 1				
BLG3701	Microbial Ecology	7	**8**	MBL3632, MBL3611	None
MBL3771	Physiology	7	**16**	BLG 3611, BLG3612	None
MBG3711	Microbial Genetics	7	**16**	MBL3632, MBL3631	None
CHB3731	Bioenergetics and Metabolism	7	**16**	CHB3632	None
MBL3701	Recombinant DNA Technology	7	**8**	MBL3631& MBL3632	None
	Year 3 Semester 2				
MBL3712	Biotechnology	7	**16**	MBL3631	MBL3701,MBG3711
MBL3732	Genetics	7	**16**	MBL3631& MBL3632	MBG3711
CHM3752	Organic Chemistry II	7	**16**	CHM3651	None
BLG3702	Research Methodology	7	**8**	BLG3621& BLG3622	None
CHB3722	Transmission of Genetic Information	7	**8**		CHB3711
Total Credits			**128**		

YEAR 4

COURSE CODE	COURSE NAME	NQF Level	CREDIT	PRE-REQUISITES	CO-REQUISITES
	Year 4 Semester 1				
BLG3810	Research Project	8	**32**	BLG3702	None
MIC3831	Environmental And Industrial Microbiology	8	**16**	MBL3701	None
MIC3811	Mycology	8	**8**	MBG3711	MIC3842,MIC3852,
MBL3801	Bioinformatics	8	**8**	MBL3732	None
MIC3800	Internship	8	**8**	BLG3702	None
	Year 4 Semester 2				
MBL3812	Immunology		**16**	MBG3711	MIC3842,
MIC3842	Virology	8	**8**	MBG3711	MIC3811,
MIC3862 **or** MOL3822	Medical Bacteriology **or** Applied Genetics	8	**8**	MBG3711;MBG3711, MBL3701, MBL3712, MBL3732	MIC3811 MIC 3811
MIC3852 **or** MIC3872	Parasitology **or** Developmental Biology	8	**16**	MBG3711, MBL3732 **or** MBE3771,MBL3771	MIC3811, MIC3862 None
Total Credits			110		

D.1.12. DEPARTMENT OF BIOCHEMISTRY COURSE DESCRIPTIONS

FIRST YEAR COURSES

CHM3511 CHEMISTRY 1A

Course Title: **Chemistry 1A**
Course Code: **CHM3511**
NQF Level: 5
NQF Credits: 16
Contact Hours: 4 lecture periods per week for one semester; 1 practical session per week for one semester
Course Assessment: **Continuous Assesment (**minimum of **3** tests which counts 75%, laboratory component 15% and tutorial 10%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite: None
Course Descriptor: The following topics are covered:Introduction: Matter, Measurement and Molecules; Stoichiometry: Calculations with ChemicalFormulae and Equations; Aqueous Reactions and Solutions Stoichiometry; Electronic Structure of Atoms; Periodic Properties of the Elements and Relationships Among Elements; Basic Concepts of Chemical Bonding; Basic Molecular Geometry and Bonding Theories.

CHM3512 CHEMISTRY 1B

Course Title: **Chemistry 1B**
Course Code: **CHM3512**
NQF Level: 5
NQF Credits: 16
Contact Hours: 4 lecture periods per week for one semester; 1 practical session per week for one semester
Continuous Assesment Minimum of three tests which counts 75%, laboratory component 15% and tutorial 10%).
Examination: 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination.
Prerequisite: None, **Co-requisite:** CHM3511 (Chemistry 1A)
Course Descriptor: The following topics are covered:Gases; Intermolecular Forces, Liquids and Solids; Properties of Solutions; Thermochemistry and Further Aspects of Chemical Thermodynamics; Chemical Kinetics; Chemical Equilibrium; Acid-Base Equilibria Additional Aspects of Aqueous Equilibria: The Common-Ion Effect, Buffer Solutions, Acid-Base Titrations; Electrochemistry.

FIRST YEAR COURSES

BLG3511 INTRODUCTION TO BIOLOGY

Course title:	**INTRODUCTION TO BIOLOGY**
Code:	**BLG3511**
NQF level:	5
Contact hours:	4 lectures / week for one semester and one 3-hour practical session per week and 1hour tutorial per week
Credits:	**16**
Course assessment:	Continuous assessment **40%** (55 % - minimum of 2 tests and 40% - at least 10 graded practical reports and 5%- at least 2 tutorial assignments) Examination **60%** (1 x 3 hour examination paper)
Prerequisites:	None

Course description: This is an introductory biology course that is designed to allow students to acquire a strong foundation into the biological sciences. The following topics will be covered: Basic techniques in biology such as microscopy, drawing, the scientific method and writing of scientific reports will be covered; Introduction to systems of classification (taxonomy and binomial nomenclature, including the five kingdoms and the three domain system); Organization of life (levels of organization): Molecule, organelle, cell, tissue, organ, organ system, organism, population, community, ecosystem (including the scales in ecology), biosphere; Chemical basis of life: carbohydrates, proteins, nucleic acids, lipids and fats, water; Cell biology: prokaryotic and eukaryotic cells, ultra-structure of plant and animal cells, cytoskeleton, membrane structure and function, cell cycle, cell division; Genes, chromosomes, genomes, Mendelian genetics, extensions to Mendelian genetics, chromosome theory of inheritance; Early theories on evolution, Evolution by natural selection (microevolution vs macroevolution), phylogeny and evolutionary relationships in five kingdoms. (Concepts such as homology and analogy; body symmetry (radial, bilateral), cephalisation, body cavities: diploblastic, triploblastic (acoelomate and coelomate [deuterostomes and protostomes]) will be covered)

BLG3512 DIVERSITY OF LIFE

Course title:	**DIVERSITY OF LIFE**
Code:	**BLG3512**
NQF level:	5
Contact hours:	4 lectures / week for one semester and one 3 hour practical session per week and 1hour tutorial per week
Credits:	16
Course assessment:	Continuous assessment **40%** (55 % - minimum of 2 tests and 40% - at least 10 graded practical reports and 5%- at least 2 tutorial assignments); Examination **60%** (1 x 3-hour examination paper)
Prerequisites:	None

Course description: This course is designed to give students a detailed understanding of the diversity of life. This course gives students the broader appreciation of biodiversity in the different ecological habitats. The following topics will be covered: introduction to systems of classification, taxonomy and binomial nomenclature, including the five kingdom and the three domain system. This course will cover topics of viral, bacterial, fungal, algal and plant diversity. It then considers the characteristics and life cycles of the following important algae and plant groups: chlorophyta, phaeophyta, rhodophyta, chrysophyta, euglenophyta, pyrrophyta, cryptophyta, bryophytes, seedless vascular plants, gymnosperms, and the angiosperms. Protostomate phyla: Nemertea, Mollusca, Anellida, Arthropoda, Nematoda, Rotifera, Lophophorates, Onychophora. Deuterostomate phyla: Echinodermata, Hemichordata and Chordata (Subphyla: Urochordata, Cephalochordata and Vertebrata: Class Myxiniformes, Petromyzontiformes, Placoderms, Chodrichthyes, Actinopterygii, Actinistia, Dipnoi, Amphibia, Reptilia, Aves, Mammalia). Examples from Namibia shall be used where possible and applicable. The course content shall be supplemented with appropriate weekly practical sessions in the laboratory and in the field.The course shall describe diagnostic characteristics of principle taxonomic categories for each phylum. Coverage of each phylum shall follow a phylogenetic approach as well as introduce broad ecological and physiological principles. Various aspects of reproduction and development shall be highlighted.

SECOND YEAR COURSES

CHM3611 INORGANIC CHEMISTRY I

Course Title:	**Inorganic Chemistry I**
Course Code	**CHM 3611**
NQF Level	6
Contact Hours:	4 lecture periods per week for one semester and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	**Continuous Assesment (**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite:	CHM3511 (Chemistry 1A), CHM 3512 (Chemistry 1B)

Course Descriptor: This is an introductory course to inorganic chemistry. It builds upon what is covered in the First Year chemistry courses. Students are expected to review the structure of the atom on their own, then the course progresses into its reactivity to form simple and complex molecule. The following topics are covered:In-depth studies of chemical bonding; (valence bond theory (VBT), shapes of molecules and hybridization; molecular orbital theory (MOT) in diatomic and polyatomic molecules); Delocalized multiple bonding. S-block elements: The chemistry of alkali and alkaline earth elements (groups 1 and 2); reactivity with hydrogen, oxygen, halogens, water, and liquid ammonia; Classification of oxides, and their reaction with water; P-block elements (groups 13 to 18): Reactivity with oxygen and halogens; The hydrides of P block elements; Hydrolysis and ammonolysis of P-block halides;

CHM3651 ORGANIC CHEMISTRY I

Course Title:	**ORGANIC CHEMISTRY I**
Course Code	**CHM3651**
NQF Level	6
NQF Credits	16
Contact Hours	4 lecture periods per week for one semester; 1 practical session per week for one semester
Course Assessment	**Continuous Assesment (**minimum of three tests which counts 68%, laboratory component 20% and tutorial 12%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination.
Prerequisite	CHM3511 (Chemistry 1A), CHM3512 (Chemistry 1B)

Course Descriptor: Basic concepts: bonding, structural representation, molecular shapes, introduction to stereochemistry, functional groups and their interchangeability, acid-base reactions of carboxylic acids and amines; Alkanes and cycloalkanes: nomenclature, physical properties, conformational analysis, bicyclic and polycyclic alkanes, reactions and synthesis of alkanes. Stereochemistry:

stereoisomers, enantiomers, chirality, diastereomers, racemates, meso compounds, optical activity, resolution. Nucleophilic substitution and elimination: nucleophiles and electrophiles, S_N2 and S_N1 reactions; carbocations and carbanions, E1 and E2 reactions. Alkenes and alkynes: physical properties and synthesis, hydrogenation, index of hydrogen deficiency, preparation, addition reactions, Markovnikov's rule, hydroboration, oxidation reactions. Radical reactions: free radicals, halogenation of alkanes, chain reactions. Alcohols and ethers: synthesis, reactions, mesylates and tosylates, epoxides, crown ethers, phase transfer catalysis, synthesis and reactions of epoxides.

CHM3631 PHYSICAL CHEMISTRY I

Course Title:	**Physical Chemistry I**
Course Code	**CHM3631**
NQF Level	6
Contact Hours:	4 lecture periods per week for one semester and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	**Continuous Assesment (**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3511(Chemistry 1A), CHM3512 (Chemistry 1B), MAT3511 (Basic Mathematics), MAT3512 (Precalculus)

Course Descriptor: The properties of gases: the perfect gas; real gases. The First Law of Thermodynamics: work, heat, and energy; the change in internal energy; expansion work; heat transactions; enthalpy; adiabatic changes; thermochemistry; state functions and exact differentials. The Second Law of Thermodynamics: the direction of spontaneous change and the dispersal of energy; entropy; Carnot cycle; entropy changes accompanying specific processes. The Third Law of thermodynamics. The Helmholtz and Gibbs energies.Standard reaction Gibbs energies. Combining the First and Second Laws of Thermodynamics. Physical transformations of pure substances: phase diagrams; phase stability and phase transitions. Simple mixtures: the thermodynamic description of mixtures; the properties of solutions. Chemical equilibrium: spontaneous chemical reactions; the response of equilibria to different conditions.

CHP3621 RADIOCHEMISTRY

Course Title:	**Radiochemistry**
Course Code	**CHP3621**
NQF Level	6
Contact Hours:	2 lecture periods per week for one semester
NQF Credits	8
Contact Hours	2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Course Assessment	**Continuous Assesment (**minimum of two tests which counts 75% and Assignment plus laboratory component 25%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3511; CHM3512

Course Descriptor: Radiochemistry: Stability of the nucleus, modes of radioactive decay, kinetics of decay, secular and transient equilibrium, methods of measurement, statistics, health and safety, applications of ionising radiation in chemistry and biochemistry.

CHB3632 BIOMOLECULES AND CATALYSIS

Course Title:	**Biomolecules and Catalysis**
Course Code	**CHB3632**
NQF Level	6
Contact Hours:	4 lecture periods per week for one semester and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	**Continuous Assesment (**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3511 (Chemistry 1A, and CHM3512 (Chemistry 1B)
Cor**equisite**	CHM3651OrganicChemistry I

Course Descriptor: The following topics are covered:**Composition and structure of biomolecules; Biochemical reactions in aqueous solutions; Energy and biochemical reactions; The medium of Life – Water; Isomers/Stereoisomers and chirality in biochemical systems; Thermodynamics of Biological Systems; Carbohydrates:** Structure and Chemistry; Glycoproteins and their functions; Reactions; **Lipids:** classification and structure; terpenes and steroids; fatty acids; triacylglycerols; glycerophospholipids and glycosphingolipids; **Amino acids and proteins:** structure and properties; reactions; separation and analysis of mixtures of amino acids; ionisation; folding and conformation; **Membranes and membrane transp**or**t:** chemical and physical properties of membranes; structure and chemistry of membrane proteins; Transport across biological membranes; importance of light energy in transport processes; **Nucleotides and Nucleic acids:** structure and chemistry of nitrogenous bases; nucleosides; structure and chemistry of nucleotides; different classes of nucleic acids; structures of nucleic acids; **Introduction to Enzymes:** nomenclature; proteins as catalysts; kinetics and specificity; kinetics of enzyme-catalysed reactions; inhibition of enzyme activity; **Introduction to Mechanisms of enzyme action and enzyme regulation**

CHM3602 ANALYTICAL CHEMISTRY I

Course Title:	**Analytical Chemistry I**
Course Code	**CHM3602**
NQF Level	6
NQF Credits	8
Contact Hours	2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Course Assessment	**Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3511 (Chemistry 1A), CHM3512 (Chemistry 1B)

Course Descriptor: Review of some fundamental concepts; sampling and sample preparation; expressions of concentration and content; evaluation of analytical data; measures of accuracy and precision; random and systematic errors; aqueous equilibria; mass and charge balance equations; principles of titrimetry; acid-base titrations; titration curves and indicators; applications of acid-base titrations; distillation, extraction, gravimetric methods of analysis; common ion and diverse ion effects; precipitation titrations; indicators used in precipitation titrations; introduction to chromatographic methods; gas chromatography; principles of gas-liquid chromatography; and basic information about spectroscopic methods of analysis.

BLG3611 ANIMAL FORM AND FUNCTION

Course title: **ANIMAL FORM AND FUNCTION**
Code: **BLG3611**
NQF Level: 6
Contact hours: 4 lecture periods per week for one semester and one three-hour practical session per week
Credits: 16
Course assessment: Continuous assessment **40%**: Practicals (at least 10 graded practicals), Theory (3 tests) Examination **60%**: 1x3 hour theory paper
Prerequisites: **BLG3511** Introduction to Biology and **BLG3512** Diversity of Life
Course description: Introduction: Animal Structural Design and Classification. Protection and the integumentary system. Skeletal systems and movement: Hydrostatic, endo-and exo-skeletons, amoeboid movement, cilia and flagella, muscle structure and physiology. Nutrition and digestion: Feeding on particulate matter, liquids and solid food masses. Digestive systems of different animal groups. Homeostasis: Positive and negative feedback, osmoregulation and thermoregulation. Respiration and gas exchange: Simple diffusion, tracheal systems, book lungs, gills, cutaneous and lungs. The nervous system and sense organs: Nervous systems in different animal groups, neurons, the resting and action potential, the synapse, divisions of the vertebrate nervous system. The Endocrine System. Circulation and Immunity.Reproduction.

MBL3631 CELL MOLECULAR BIOLOGY AND GENETICS

Course title: **CELL MOLECULAR BIOLOGY AND GENETICS**
Code: **MBL3631**
NQF level: 6
Contact hours: 4 lecture periods per week for one semester and one three hour practical session per week
Credits: 16
Course assessment: Continuous assessment **40%** (60 % - minimum of 2 tests and 40% - at least 10 graded practical reports) Examination **60%** (1 x 3 hour examination paper)
Prerequisites: **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life
Course description: Chemical basis of life: water, essential and trace elements, bonds; macromolecules: proteins, carbohydrates, and nucleic acids; lipids and fats; cell structure and function; properties and function of enzymes, and models for binding; cell membrane; cell communication; cell cycle and DNA replication; cellular respiration: glycolysis, transition reaction, Krebs cycle, electron transport chain; and gene expression: transcription and translation.

BLG3621BIOMETRICS I

Course title: **BIOMETRICS I**
Code: **BLG3621**
NQA level: 6
Contact hours: 2 lecture periods per week for one semester and one 3-hour practical session every second week for one semester.
Credits: 8
Course assessment: Continuous assessment **40%:** (Practicals –at least 6 assessed practicals – contribute 40% to CA); Theory (2 tests, 1 assignment – contribute 60% to CA) Examination **60%:** 1x2 hour theory paper
Prerequisites: **STS3522** Introduction to Statistics
Co-requisite: **BLG3622** Biometrics II
Course description: Probability and distributions: data types; populations; means and variances; normal distribution; data collection; sampling distributions and sampling designs. Estimation and hypothesis testing: estimation of the population mean; testing hypotheses about the population mean; population variance unknown; comparing samples; pooled estimate of variance. Simple experiments: randomization and replication; completely randomized designs with two treatments; completely randomized designs with several treatments; testing overall variation between treatments.

BLG3612 PLANT FORM AND FUNCTION

Course title: **PLANT FORM AND FUNCTION**
Code: **BLG3612**
NQF level: 6
Contact hours: 4 lecture periods per week for one semester and one three hour practical session per week
Credits: 16
Course assessment: Continuous assessment (**40%**): Theory (not less than 2 tests and 1 assignment); Practicals (not less than 10 marked assignments). Examination (**60%**): 1 x 3 hour theory paper
Prerequisites: **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life
Course description: Scope and introduction to Pant Biology -Traits common to all plants: Apical meristems, Alternation of generations, dependent multicellular embryo, sporangia and gametangia. Review of major groups of plants: survey through the 10 extant plant phyla - Hepatophyta, Anthocerophyta, Bryophyta, Lycophyta, Pterophyta, Cycadophyta, Gingkophyta, Gnetophyta, Coniferophyta and Magnoliophyta. Topics will emphasize the morphological adaptations of plants, the genetic properties of plant populations, plant reproduction and mating system variation, a survey of biotic and abiotic ecological interactions important to flowering plants. Plant Structure, Growth and development, Functional Plant -Microbe Associations, Stem Form and Function, Roots Form and Function, Leaves Form and Function, The flowering Plant and Animal Coevolution, Plant Adaptation to various environments. Laboratory work will include a survey of flowering plant taxonomy and plant forms and functions. Laboratory projects will explore various plant structures in selected groups, and discuss functional relationships, as well as identifying adaptive features of plant form and function.

MBL3632 INTRODUCTION TO MICROBIOLOGY

Course title: **INTRODUCTION TO MICROBIOLOGY**
Code: **MBL3632**
NQA level: 6
Contact hours: 4 lecture periods per week for one semester and one 3-hour practical session per week for one semester.
Credits: 16
Course assessment: Continuous assessment **40%:** Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment) Examination **60%:** 1x3 hour theory paper
Prerequisites: **BLG3511** Introduction to Biology, **BLG3512** Diversity of Life.
Course description: The course includes principles of microbiology, importance of microorganisms, microorganisms as cells, microorganisms and their natural environments, impacts of microorganisms on humans, and pathways of discovery in microbiology:

historical roots of microbiology, Pasteur and the defeat of spontaneous generation, Koch postulates, infectious disease, pure culture microbiology. Microbial diversity and the rise of general microbiology. The modern era of microbiology. It will also give an overview of microbial life, cell structure and evolutionary history, physiological diversity of microorganisms, prokaryotic diversity, and eukaryotic microorganisms. Other topics are microscopy and cell morphology, microbial cell membranes and cell walls, surface structures and inclusions, endospores, microbial motility and chemotaxis, staining techniques, microbial nutrition, culture media, laboratory culture of microorganisms, enrichment and isolation, isolation of pure cultures, bacterial cell division, growth of bacterial populations, measuring microbial growth, environmental effects on microbial growth, control of microbial growth, microbial evolution and systematics, Eubacteria, Achaea, eukaryotic microorganisms, viruses, bacteriophages, prions, diversity of microbial metabolism, microbial ecology, and methods in microbial ecology.

BLG3622 Biometrics II

Course title:	**BIOMETRICS II**
Code:	**BLG3622**
NQA level:	6
Contact hours:	2 lecture periods/week for one semester and one 3-hour practical session every second week for one semester.
Credits:	8
Course assessment:	Continuous assessment **40%:** (Practicals –at least 6– contribute 40% to CA); Theory (2 tests, 1 assignment – contribute 60% to CA) Examination **60%:** 1x2 hour theory paper
Prerequisites:	**STS3522** Introduction to Statistics
Co-requisite:	**BLG3621** Biometrics I

Course description: Control of the random variation: local control of variation; blocking; randomized block designs; meaning of error mean square; assumptions behind analysis; significance tests; comparison of two samples; one-way ANOVA; factorial experiments; split plots; Latin square designs; Studying linear relationships: linear regression; correlation; inferences; analysis of covariance. More complex relationships: multiple regressions. Analysis of proportions; non-parametric statistics; choosing a good experimental design; computers and statistical analysis of data; practice and presentation of data and results.

MBL3611 MICROBIAL SYSTEMATICS

Course title:	**MICROBIAL SYSTEMATICS**
Code:	**MBL3611**
NQA level:	6
Contact hours:	4 lecture periods per week for one semester and one 3-hour practical session every week for one semester.
Credits:	16
Course assessment:	Continuous assessment **40%**: Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment) Examination **60%**: 1x3 hour theory paper
Prerequisites:	**BLG 3512** Diversity of Life

Course description: Microbial diversification, endosymbiotic origin of Eukaryotes. Microbial evolution: the evolutionary process, evolutionary analysis (theoretical aspects and analytical methods), microbial phylogeny, application of SSU rRNA phylogenetic methods. Microbial systematics, with emphasis on domains bacteria and archeabacteria: Phenotypic analysis, genotypic analysis, phylogenetic analysis, the species concept in microbiology, classification and nomenclature. The proteobacteria: Phylogenetic overview of bacteria, purple phototrophic bacteria, the nitrifying bacteria, sulphur and iron-oxidizing bacteria, hydrogen-oxidizing bacteria, methanotrophs and methylotrophs. Aerobic and facultatively aerobic chemoorganotrophic proteobacteria: Pseudomonas and Pseudomonads, acetic acid bacteria, free-living aerobic and nitrogen-fixing bacteria, Neisseria, Chromobacterium and relatives, enteric bacteria, Vibrio, Aliivibrio and Photobacterium, Rickettsias. Morphologically unusual proteobacteria: Spirilla, Sheathed proteobacteria (Sphaerotilus and Leptothrix), Budding and prosthecate/stalked bacteria. Delta and epsilon-proteobacteria: Gliding myxobacteria, sulphate and sulphur-reducing proteobacteria, the epsilonproteobacteria. The practicals will include identification of bacteria based on morphological, physio-biochemical properties that enables classifications of bacterial phyla.

THIRD YEAR COURSES

CHB3741 BIOCHEMICAL ANALYSIS

Course Title:	**Biochemical Analysis**
Course Code	**CHB3741**
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
Course Assessment	**Continuous Assessment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	Biomolecules and Catalysis (CHB3632)

Course Descriptor: Review of Amino Acids, Peptides and Proteins**; Separation Methods:** Principles of Separation techniques, Methods based on: polarity, ionic nature, size and shape; Chromatography and Spectroscopy; **Immunological Methods:** Antigen-Antibody reactions, precipitation reaction, immunoassay: **Enzymes:** enzyme assay methods; **Carbohydrates:** chemical and enzymatic methods; identification of carbohydrate mixtures; **Amino Acids:** n-terminal analysis, reactions and separation of amino acids, amino acid analyser; **Proteins:** methods of separation and quantitation; **Lipids:** Sample preparation and handling, separation and quantitation; **Nucleic Acids**: Isolation and purification, analysis, vectors and sequencing, matrix-assisted laser desorption-ionization mass spectroscopy MALDI-MS, (MALDI-TOF)

CHP3701 WATER ANALYSIS

Course Title:	**Water Analysis**
Course Code	**CHP3701**
NQF Level	7
NQF Credits	8
Contact Hours	2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Course Assessment	**Continuous Assessment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.

Prerequisite Analytical Chemistry I (CHM3602)
Compulsory/Elective Elective
Course Descriptor: Surface water, Ground water, drinking water quality, physical properties of ground water and its occurrence, water analysis: physical properties of water, determination of chlorides, sulphates, carbonates, bicarbonates, acidity, turbidity, pH, metal ions, Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), suspended solids (SS), Total Dissolved Solids (TDS), residual chlorine, Water management.

CHB3731 BIOENERGETICS AND METABOLISM

Course Title:	**Bioenergetics and Metabolism**
Course Code	**CHB3731**
NQF Level	7
Notional Hours	160
Contact Hours:	4 lecture periods per week for one semester and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	**Continuous Assessment (**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHB3632 **(**Biomolecules and Catalysis)

Course Descriptor: The following topics are covered:**Introduction to metabolism:** metabolic pathways and organic reaction mechanisms; experimental approaches in metabolism; thermodynamics of phosphate groups and thermodynamics of life**; Glucose metabolism:** Glycolysis; pathways; reactions; fermentation; other hexoses metabolism; **Other pathways of carbohydrate metabolism:Glycogen** breakdown; - synthesis; - control; -storage diseases; gluconeogenesis; Glyoxylate cycle; Biosynthesis of Oligosaccharides and glycoproteins; pentose phosphate pathway; **Citric Acid Cycle:** Cycle overview; Conversion of pyruvate to acetyl-CoA; Enzymes of the citric acid cycle; catabolic and anabolic of the citric acid cycle; Regulation of the citric acid cycle; **Lipid metabolism:** lipid digestion, absorption and transport; fatty acid oxidation and ketone bodies; fatty acid synthesis; synthesis of other lipids; cholesterol metabolism; phospholipid and glycolipid metabolism; **Amino acid metabolism:** amino acid deamination; amino acid biosynthesis; Nitrogen fixation and assimilation; transamination; Metabolic breakdown of individual amino acids; amino acids as metabolic precursors; nitrogen fixation

CHP3741 MEDICINAL CHEMISTRY I

Course Title:	**Medicinal Chemistry I**
Course Code	**CHP3741**
NQF Level	8
NQF Credits	8
Contact Hours	2lecture periods per week for one semester; 1 practical session per week for 7 weeks
Course Assessment	**Continuous Assessment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.

Prerequisite CHM3651(Organic chemistry I, prerequisite), SCHP3721 (Drug Discovery & Development, co-requisite)
Course Descriptor: Design, discovery, and preparation of biologically active compounds; mechanisms of drug action; pharmacokinetics: absorption, distribution, drug metabolism, excretion; prodrugs and drug delivery systems; lead optimization:retrosynthetic analysis, functional groups and isosteres, functionalization of aromatic rings, construction of rings, heterocyclic chemistry; stereoselective synthesis and stereochemistry in drug design. Structure-activity relationships and quantitative structure-activity relationships. Molecular targets for drugs: receptors, enzymes, ion channels, DNA and unexplored targets revealed by the human genome project.

CHP3721 DRUG DISCOVERY & DEVELOPMENT

Course Title:	**Drug Discovery & Development**
Course Code	**CHP3721**
NQF Level	8
NQF Credits	8
Contact Hours	2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Course Assessment	**Continuous Assessment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3651 (Organic chemistry I)

Course Descriptor: History of drug discovery; stages in the drug development process; classification of drugs; sources of drugs and lead compounds; bioassays; pharmacophores; target-based and structure-based drug design; clinical trials; ethics, patents; strategies in drug discovery for communicable and non-communicable diseases; impact of genomics, combinatorial chemistry and other modern techniques on drug research; case studies to outline the drug development process;

CHM3721 ANALYTICAL CHEMISTRY II

Course Title:	**Analytical Chemistry II**
Course Code	**CHM3721**
NQF Level	7
NQF Credits	8
Contact Hours	2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Course Assessment	**Continuous Assessment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3602 (Analytical Chemistry I)

Course Descriptor: Complexometric methods and EDTA titrations; oxidation reduction, oxidation states and balancing redox equations, the half-cell concept; voltaic cells and the Nernst equation; redox titrations and redox titration curves; applications of redox titrations, coulometric and potentiometric methods of analysis.

CHM3751 INORGANIC CHEMISTRY II

Course Title:	**Inorganic Chemistry II**
Course Code	**CHM3751**
NQF Level	7
Contact Hours:	4 lecture periods per week for one semester and1 practical session per week for one semester
NQF Credits	16
Course Assessment	**Continuous Assessment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3611 (Inorganic Chemistry I), MAT3512 (Precalculus)

Course Descriptor: The following topics are covered:
Transition metal chemistry: transition metal complexes (constitution, nomenclature, isomerism, classification of ligands); Bonding-Application of Valence Bond Theory (VBT); Crystal Field Theory (CFT); Ligand Field Theory (LFT). Molecular Orbital Theory (MOT); Reaction Mechanisms and rate of reactions; Ligand substitution; Dissociative and Associative mechanisms; redox and photochemical reactions in transitional complexes. Chemical applications of group theory: Continuation of symmetry elements and symmetry operations, point group and character tables. Symmetry applications; Infrared and Raman spectroscopy. In-depth treatment of chemical bonding and molecular orbital theory, Electronic spectra of transition metal complexes; Russel-Saunders and ligand field terms, selection rules and electronic transitions

CHP3711 ENVIRONMENTAL CHEMISTRY I

Course Title:	**Environmental Chemistry I**
Course Code	**CHP3711**
NQF Level	7
NQF Credits	16
Contact Hours	4 lecture periods per week for one semester; 1 practical session per week for one semester
Course Assessment	**Continuous Assessment (**minimum of 3 tests which counts 75% and laboratory component 25%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	Radiochemistry (CHP3621)

Course Descriptor: Environmental radioactivity, radiochemical methods of analyses of environmental samples, radiological protection, dosimetry and the associated legislation Perceptions of the Environment, Natural Environments, Environmental Variation, The atmosphere and atmospheric chemistry, soil chemistry, Environmental Assessment Process, An Introduction to Climate Change, Climate Change Adaptation.

CHB3722 TRANSMISSION OF GENETIC INFORMATION

Course Title:	**Transmission of Genetic Information**
Course Code	**CHB3722**
NQF Level	7
Contact Hours:	2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
NQF Credits	8
Course Assessment	**Continuous Assessment (**minimum of 2 tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	Biomolecules and Catalysis (CHB3632)

Course Descriptor: This course is designed to teach the students the Expression and transmission of genetic information: The following topics are covered: **Nucleotide metabolism:** synthesis of purine ribonucleotidees; synthesis of pyrimidine ribonucleotides; formation of deoxyribonucleotides; nucleotide degradation; biosynthesis of nucleotide Coenzyme; **DNA Metabolism:** DNA Replication, Recombination and Repair; **RNA Metabolism:** Transcription and RNA Processing; **Protein Metabolism:** Translation and Posttranslational Modification; Genes and Chromosomes, Regulation of Gene Expression; Recombinant DNA technology

CHM3761 INDUSTRIAL CHEMISTRY I

Course Title:	**Industrial Chemistry I**
Course Code	**CHM3761**
NQF Level	7
Contact Hours:	2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
NQF Credits	8
Course Assessment	**Continuous Assessment (**minimum of 2 tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3611 (Inorganic Chemistry I), CHM3651 (Organic Chemistry I)

Course Descriptor: The following topics are covered: **Sources of chemical industry:** inorganic chemicals, organic chemicals from biomass, coke, natural gas, crude oil. **The w**or**ld's maj**or **chemical industries:** introduce the major companies and products. **Environmental pollution control:** the techniques of pollution control including physic, chemical and biological methods. **Material and energy balance:** the methods of mass and energy balance, the calculation process of industrial chemistry. **Technological economics:** cost and profit of producing processes, effects of scale and flow rate of operation. **Oil and fat industry:** structure, isolation, additives, applications. **Coatings industry:** composition, pigments, binders, solvents. **Soap and domestic industry:** soap, surfactant, detergent. **Leather industry**: softening, evaluating effects of fat in leather. **Flav**or **industry:** vehicles, fixatives, synthetics used in perfume and flavors; perfume formation. **Pharmaceutical industry:** type of drugs, antibacterial agents, steroids, analgesics, antihistamines. **Meat industry:** kinds of meat, prepared and preserved products. **Fish industry:** categories of fish, prepared and preserved products. **dairy industry:** prepared and preserved products. **Biotechnology industry:** beer, cheese. **Sulfuric acid and fertilizer industry:** manufacture of sulfuric acid and fertilizer. **Salt industry:** manufacture of caustic. **Uranium industry:** extraction, concentration and purification of uranium. **Cement industry:** the compositions and manufacture of cement, processes in the solidification cement.

CHM3752 ORGANIC CHEMISTRY II

Course Title:	**ORGANIC CHEMISTRY II**
Course Code	**CHM3752**
NQF Level	7
NQF Credits	16
Contact Hours	4 lecture periods per week for one semester; 1 practical session per week for one semester
Course Assessment	**Continuous Assessment (**minimum of 3 tests which counts 68%, laboratory component 20% and quiz 12%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.

Prerequisite CHM3651 (Organic Chemistry I)

Course Descriptor: Carbonyl compounds: structure and reactions with nucleophiles, Oxidation-reduction in organic chemistry, alcohols by reduction, oxidation of alcohols, organometalic compounds. Basic spectroscopy: IR, NMR, MS. Conjugated systems: allyl radical and allyl cation, alkadienes and polyunsaturated hydrocarbons, 1,2- and 1,4-addition, Diels-Alder reaction. Aromatic compounds: Hückel's rule, aromatic-, antiaromatic-, nonaromatic-classification; annulenes, fullerenes, Heterocyclic compounds. Electrophilic aromatic substitution: halogenation of benzene, nitration, sulfonation, Friedel-Crafts-alkylations and acylations. Protecting and blocking groups. Aldehydes and ketones: synthesis; addition to carbon-oxygen double bond, hydride, hydrogen cyanide, alcohols, derivatives of ammonia, oxidation; Wittig reaction. tautomers, enolates, aldol reactions, aldol reactions.

CHM3712 PHYSICAL CHEMISTRY II

Course Title: **Physical Chemistry II**
Course Code **CHM3712**
NQF Level 7
Contact Hours: 4 lecture periods per week for one semester, 1 tutorial session per week for one semester and 1 practical session per week for one semester
NQF Credits 16
Course Assessment **Continuous Assessment** **(**minimum of 3 tests which counts 70%, laboratory component 20% and Quiz 10%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite CHM3631 (Physical Chemistry I), MAT3611 (Calculus I)

Course Descriptor: The rates of chemical reactions: rate expressions; order and molecularity. Integrated rate equations.Methods of determining order or reaction and rate coefficient.Temperature dependence of rate coefficients (Arrhenius equation).Complex reactions – parallel, opposing, consecutive and chain reactions.Reaction mechanism.Enzyme kinetics. Theories of reaction rates: collision theory; transition state theory. Experimental methods for studying slow and fast reactions.Definition and measurement of conductivity and molar conductivity. Kohlrausch's law. Strong and weak electrolytes.Ostwald dilution law. Ionic mobilities and transport numbers. Applications of conductivity measurements – dissociation constant, solubilities and solubility products of sparingly soluble salts, conductometric titrations.Thermodynamics of electrolyte solutions. Thermodynamics of electrochemical cells, Surface chemistry and colloids: Chemical, biological and medicinal applications of colloids. Processes at electrodes: The electrode-solution interface. The rate of charge transfer.Butler-Volmer equation.Surface tension and interfacial tension, Spreading of one liquid on another. Insoluble monolayer films and their application in water evaporation control. Detergency.Formation and stability of emulsions. Chemisorption and Physisorption. Adsorption isotherms: Langmuir, Freundlich and BET adsorption equations.

CHB3762 INNOVATION AND ENTREPRENEURSHIP

Course Title: **Innovation and Entrepreneurship**
Course Code **CHB3762**
NQF Level 8
NQF Credits 8
Contact Hours: 2lecture periods per week for one semester
Course Assessment **Continuous Assessment** **(**minimum of 2 tests which counts 80% and Internship and or Innovation project applied component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite Drug design and development CHP3721, Biochemical Analysis, CHB3741

Course Descriptor: Introduction to innovation and entrepreneurship; Entrepreneurship in biotechnology (Context specific); O**rganizational Structures;** Virtual and Real Enterprises; R & D Networks; Outsourcing Registrations/Permissions: **Markets and Fact**or**s:** Products and Services, Economies, Manpower, Resources **Research and Development;** product life cycle, R&D cycle and organizational life cycle; Biology, Medicine, and Genetics, Pre-clinical and Clinical Development, Processes, Pilot Plants, Engineering, Fermentation Process Development; **Safety:** Medical Safety, Biological Safety, Chemical Safety, Equipment Safety, **Intellectual assets** –capital in biotechnology firms; managing IP in biotechnology firms; **biotechnology value chain**; Biotechnology industry and firm structures; Product development and innovation diffusion.

CHB3742 BIOSAFETY, BIOETHICS AND IPR

Course Title: **Biosafety, Bioethics and IPR**
Course Code **CHB3742**
NQF Level 8
NQF Credits 8
Contact Hours: 2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
Continuous Assessment **(**minimum of 2 tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite None, **Co-requisite: Bioenergetics** and Metabolism (CHB3731)

Course Descriptor: Principles of biosafety, bioethics and bio-law: Environmental and food safety Risk assessment, ethics; philosophy; Regulation of human tissue and stem cells; International environmental law; Intellectual property law and the biosciences, Patenting Life; Surveying of Methods and Uses of Animal Biotechnology. Legal and socio-economic considerations regarding biotechnology; human safety; animal welfare; Public policy, regulatory and ethical challenges facing the entrepreneurial biotechnology firm.

CHM3702 INSTRUMENTAL ANALYSIS I

Course Title: **Instrumental Analysis I**
Course Code **CHM3702**
NQF Level 7
NQF Credits 8
Contact Hours 2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Continuous Assessment **(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite CHM3602 (Analytical Chemistry I), CHM 3651 (Organic Chemistry I)

Course Descriptor: ultraviolet spectroscopy; infrared absorption spectroscopy; theory and applications of IR; flame emission and atomic absorption spectrometry; molecular fluorescence and phosphorescence; NMR spectroscopy; theory and experimental methods of NMR spectroscopy; applications of proton NMR spectroscopy and mass spectrometry.

CHM3722 RESEARCH METHODOLOGY

Course Title: **Research Methodology**
Course Code **CHM3722**
NQF Level 7
Contact Hours: 2 lecture periods per week for one semester
NQF Credits 8
Continuous Assessment (minimum of two tests which counts 65%, Assignments, Oral & Poster presentation 15 %, a minimum of two equally weighted statistics exercises (10%),oral presentation using PowerPoint (5%) and a Poster presentation (5%)). **Final: 100%** CA
Prerequisite Pass in all second year Chemistry and Biochemistry courses

Course Descriptor**:** Ethics of Research and Plagiarism; The scientific method: Logic and scientific, natural observations, asking questions and formulation of hypotheses, Predictions, Types of hypotheses (null, alternative, research); Chemostatics Topics: Handling experimental data; Processing and reporting; Significant tests; Regression analysis; Validation of experimental data (quality control); Optimization of parameters; Use of existing literature; Using the internet and the university library; Finding and using literature references; Citation of references; Writing a literature review; Report Writing; Oral presentation using state-of-the-art equipment; Presenting results as posters.

BLG3701 MICROBIAL ECOLOGY

Course title: **MICROBIAL ECOLOGY**
Code: **BLG3701**
NQF level: 7
Contact hours: 2 lecture periods per week for one semester and one 3-hour practical session every second week for one semester.
Credits: 8
Course assessment: Continuous assessment **40%**: Practicals (at least 6 assessed practicals), Theory (2 tests, 1 assignment) Examination **60%**: 1x 2 hours theory paper
Pre-requisites: **MBL3632** Introduction to Microbiology; **MBL3631** Cell Molecular Biology and Genetics

Course description: Main themes include:Role of microbial life in origin of life, evolution and the ecology Microbial Interactions: Function and regulation of microbial productivity and metabolism; microbial population ecology; microbial community structure; Microbial food webs; Physiological Microbial Ecology: Redox cascade; Thermodynamics and microbial ecology; Growth curves, morphology and metabolic diversityBiogeochemical cycling: Carbon cycle, Nitrogen cycle, Phosphorus cycle, Sulfur cycle
Extremophiles: Definition of an extreme environment; thermophiles (hydrothermal vents, cold seeps and deserts); acidophiles and alkalophiles (micro flora in the gut; peats and bogs) Microbiological and molecular techniques in Microbial Ecology: Quantitative ecology (numbers, biomass, metabolic activity); method for species identification; Metagenomic analysis of communities.

MBL3771 PHYSIOLOGY

Course title: **PHYSIOLOGY**
Code: **MBL3771**
NQF level: 7
Contact hours: 4 lecture periods per week for one semester, 3 hour practicals per week for one semester
Credits: 16
Course assessment: Continuous assessment **40%**: Practicals (at least 10 assessed practicals), Theory (3 tests) Examination **60%**: 1x3 hour theory paper
Prerequisites: **BLG3611**, Animal Form and Function**, BLG3612** Plant Form and Function

Course description: Energy and its use by plants ; Sunlight as source of energy and information; Photosynthesis – the leaf as a photosynthetic machine; Respiration ,Nitrogen metabolism – the nitrogen cycle, biological nitrogen fixation ,Water & solute uptake by cells; Mineral nutrition – essential elements, beneficial elements, soils and plant nutrition, interactions with bacteria, interaction with fungi, kinetics of ion uptake, movement of water and solutes into the roots; Whole plant water uptake Transport of photosynthetic products. Cellular and animal energetics. Physico-chemical effects of temperature, and temperature and metabolic rates. Membrane physiology and solute regulation by cells and electrophysiology of cells. Control of various body functions e.g. growth and regeneration, reproduction, iono-and osmoregulation, cellular metabolism and color by neurohormonal and classic hormonal systems. Physiology of respiration, haemoglobin and the factors that influence its oxygen carrying capacity, the Bohr effect. Blood chemistry and the physiological role of formed elements.Physiological role of water and solute regulation in terrestrial and aquatic animals.Feeding: cell secretion and movement (secretion and peristalsis by gut tube), cellular biochemistry (digestive enzymes and biochemistry of hydrolysis of various organic substrates) and nutrition (role of minerals and vitamins).

BLG3702 RESEARCH METHODOLOGY

Course title: **RESEARCH METHODOLOGY**
Code: **BLG3702**
NQF level: 7
Contact hours: 2 lecture session per week, 3 hour practical every other week for one semester
Credits: 8
Course assessment: Continuous assessment **100%** (5 assessed assignments, 1 test). Students should have prepared and presented their research proposal for their research project at the end of this course.
Prerequisites: **BLG3621** Biometrics I, **BLG3622** Biometrics II

Course description: Ethics of research. The scientific method: logic and the scientific, natural observations, asking questions and formulation of hypothesis, predictions. Types of hypotheses; null, alternative, research. Biological variation, populations and sampling.Statistical significance.Experimental (research study /project) design.Data collection & keeping / documenting research data and other records. Scientific writing, Plagiarism, Finding and using literature references, Citation of references. Writing a literature review.Writing a research proposal.Report writing. Presenting results in an oral presentation. Presenting results as posters.

EBL3771 CONSERVATION BIOLOGY AND BIODIVERSITY

Course title: **CONSERVATION BIOLOGY AND BIODIVERSITY**
Code: **EBL3771**
NQF level: 7
Contact hours: 4 lecture periods per week for one semester, 3 hours practical per week for one semester
Credits: 16

Course assessment: Continuous Assessment **40%**: Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment)
Examination **60%**: 1 x 3 hr theory paper
Prerequisites: **EBL3631** Introduction to Ecology
Course description: Students will study in depth: Introduction: History and definition of Conservation Biology and Biodiversity. Biodiveristy: Global patterns, distribution and measurement of biodiversity with special emphasis on Namibian biodiversity; Biodiversity inventories; rapid biodiversity assessment. Environmental ethics. Ecological Economics: valuation of biodiversity with emphasis on the direct use value, indirect use value, option value, and existence value. Threats to Biological Diversity: Extinction with special emphasis on the causes of extinction (Habitat destruction, habitat fragmentation, habitat degradation and pollution, global climate change, overexploitation, invasive and alien species, and disease) as well as species vulnerability to extinction. Island Biogeography and extinction rates. Conservation at the population and species level: Species categories (keystone, indicator, flagship, umbrella and economically important species), Essential concepts and problems of small populations. Applied population biology: Studying populations, population viability analysis, metapopulations, establishing new populations, *Ex Situ* conservation, Conserving Biological Communities: Prioritising, establishing and classifying protected areas, Reserve design and conservation networks, SLOSS model, managing protected areas. Habitat restoration.Biodiversity conservation agreements.

EBL3721 BIOSYSTEMATICS I

Course title: **BIOSYSTEMATICS I**
Code: **EBL3721**
NQF level: 7
Contact hours: 2 lecture periods / week for one semester and 1 practical every second week for one semester
Credits: 8
Course assessment: Continuous Assessment: Continuous assessment 40%: Practicals 35% (5 or more assessed practical work), Theory 45% (3 tests, 1 assignment), Specimen Collecting project (15%); seminar presentations (5%). Examination 60%: (1 x 2 hours theory paper)
Prerequisites: BLG3612 Plant Form and Function, **BLG 3611** Animal Form and Function
Course description: This course will lay the foundation of biosystematics as follows:**Introduction to biological systematics: Definitions, Importance, Roles and Values**Methods of identification, Taxonomic characters; Taxonomic keys: types (their merits and demerits), use and construction of. Plant Morphology: General Structure Terms, those used for a specific structure/organ; terminology related to vegetative and reproductive structures Angiosperms plant familiesTaxonomic collections (**Specimens, collections, curation** and preservation of specimens, Herbarium collections and their management, The value of Natural History Collections); techniques for collecting and preserving plants; **Plant Collecting Project** (Students will be required to carry out a compulsory mini-project on the collection and preservation of plant specimens from a selection of important plant families.**Nomenclature & Classification -** the data and procedures employed in the practical discovery, naming and description of previously undescribed species. -Principles of biological nomenclature/naming, provisions of International Codes of Botanical and Zoological Nomenclature-their operative principles, interpretation and application of important rules, formation of scientific names of various taxa; Process of typication and different Zoological and Botanical types; PhyloCode**Plant Families**– a survey of plant families with the focus on important taxonomic /distinguishing characters. Common and important families will be selected to represent various groups -Characteristics of important families in the region. flowering plant systematics and diversity**.**Current issues in biosystematics: seminar discussions on current topics in biosystematics (including nomenclature, natural history collections).Each student is required to conduct a theory seminar in which he/she explores a topic of choice from selected list of current topics in Biosystematics in the published literature e.g cases of name change, PhyloCode.

MBG3711 MICROBIAL GENETICS

Course title: **MICROBIAL GENETICS**
Code: **MBG3711**
NQF Level: 7
Contact hours: 4 lecture periods per week for one semester, 1 practical session per week for one semester
Credits: 16
Course assessment: Continuous assessment: **40%** (3 tests and at least 10 practical marks)
Examination: **60%** (1 x 3h examination paper)
Pre-requisites: **MBL3632** Introduction to Microbiology, **MBL3631** Genetics
Course description: This course covers fundamental concepts of microbial genetics and genetic engineering of microorganisms. The Structure of the bacterial DNA, Organization of the bacterial genome, Organization and replication of prokaryotic DNA. Mutations: point mutations, base-pair substitution, frameshift mutations, pyrimidine dimers . Causes of mutations: UVlight/radiation, chemical base analogues, mutagenesis. Mutation repair mechanisms: SOS repair, post-transcription repair, base excision repair. Recombination: Conjugation, transformation and transduction. Gene expression and regulation, Isolation, specific cleavage and synthesis of DNA.Molecular tools and DNA cloning, bioinformatics and proteomics.Vectors, Transformation, Identifying recombinants. Specifically, the course will deal with the principles of genetic engineering for *Escherichia coli*, gram negative bacteria, gram positive bacteria, yeast, and filamentous fungi.

EBL3722 BIOSYSTEMATICS II

Course title: **BIOSYSTEMATICS II**
Code: **EBL3722**
NQF Level: 7
Contact hours: 2 lecture periods / week for one semester and 1 practical every second week for one semester
Credits: 8
Course assessment: Continuous Assessment: Continuous assessment **40%**: Practicals 35% (5 or more assessed practical work), Theory 45% (3 tests, 1 assignment), Specimen Collecting project (15%); seminar presentations (5%). Examination **60%**: (1 x 2 hours theory paper)
Pre-requisites:BLG3612 Plant Form and Function; **BLG 3611**Animal Form and Function
Course description: This course will deal with Classification and Phylogeny in animals
Introduction to Phylogeny and systematics: Definition and basic concepts; The tree of LifeTheories of biological classification: various methods of classification systems from the earliest days to modern techniques, especially highlighting cladistics. History and Development (traditional (artificial) vs natural classifications; phenetic classification, Phylogenetic classification, Cladistics) Cladistics: Cladograms -Monophyl, Paraphyly and Polyphyl; sorting Homology and Analogy.Phylogenetic relationships within and amongst taxa: **Sources of data** (Fossil, morphological, molecular) and analytical methods (parsimony, likelihood, Bayesian) employed in phylogeography and phylogeny reconstruction;Molecular systematics reveals new insights Animal phylogeny/classification and

diversity survey of animal taxa with the focus on important taxonomic /distinguishing characters and identification terminology. Common and important taxa will be selected to represent various groups Species and speciation: Species concepts – species category, sub-species and other infra specific categories Taxonomic collections (**Specimens, collections, curation** and preservation of specimens, Museum collections and their management , The value of Natural History Collections); techniques for collecting and preserving animals; **Animal Collecting Project** (Students will be required to carry out a compulsory mini-project on the collection and preservation of selected animal specimens.Current issues in biosystematics (including natural history collections, classification and phylogeny, rankless classification.

MBL3701 RECOMBINANT DNA TECHNOLOGY

Course title:	**RECOMBINANT DNA TECHNOLOGY**
Code:	**MBL3701**
NQF level:	7
Contact hours:	2 L / week for one semester + 3h Practical every second week for one semester
Credits:	8
Course assessment:	Continuous assessment **40%**: Practicals (at least 6 assessed practicals), Theory (2 tests) Examination **60%:** 1x2 hour theory paper
Prerequisites:	**MBL3632** Introduction to Microbiology, **MBL3631** Cell Molecular Biology and Genetics

Course description: Recombinant DNA techniques were developed through discoveries in Molecular Biology. Although the experimental techniques used may vary, depending on the objectives of the investigation, a number of experimental protocols have been developed that could be considered to form the basic techniques in recombinant DNA technology. The students will critically assess and analyse the links between the research questions and the techniques to be used in order to develop the student's understanding of and appreciation for molecular biological processes. Students will have hands-on experience in laboratory sessions in both planning and executing experimental procedures. The principles and applications of the following techniques will be discussed: gel electrophoresis, restriction and other modifying enzymes, cloning vehicles and the cloning process, polymerase chain reaction, transformation, identifying recombinants, sequencing and characterizing genes.

MBL3712 BIOTECHNOLOGY

Course title:	**BIOTECHNOLOGY**
Code:	**MBL3712**
NQF level:	7
Contact hours:	4 lecture periods / week for one semester and one 3-hour practical session every second week for one semester.
Credits:	16
Course assessment:	Continuous assessment **40%** (10 graded practicals, minimum of 2 tests and 1 assignment) Examination **60%** (1 x 3 hour examination paper)
Prerequisites:	**MBL3631** Cell Molecular Biology and Genetics,
Co-requisite:	**MBL3701** Recombinant DNA Technology, **MBG3711** Microbial Genetics

Course description: Introduction to biotechnology: Definitions, scope of biotechnology, principles and techniques in genetics, biochemistry and microbiology, issues around GMOs. **Genomics**: Definitions, concepts of gene expression and analysis, techniques-genomic libraries and analysis, southern blots, applications. **Proteomics:** definitions, concepts of protein expression and analysis, Techniques-SDS PAGE gels, Western blots, applications. **Transcriptomics**: definitions, concepts of gene regulation in prokaryotes and eukaryotes and analysis, Techniques- cDNA libraries and analysis, Northern blots, applications. **Metabolomics:** definitions, concepts of metabolism and analysis, primary and secondary metabolites, Techniques-metabolic pathways and analysis.

MBL3732 GENETICS

Course title:	**GENETICS**
Code:	**MBL3732**
NQF level:	7
Contact hours:	4 lecture periods / week for one semester
Credits:	16
Course assessment:	Continuous assessment 40%: 10 graded Practicals and 2 theory tests. Examination 60%: 1 x 3 hour theory paper.
Prerequisites:	**MBL3631** Cell Molecular Biology and Genetics, **MBL3632** Introduction to Microbiology
Co-requisite:	**MBG3711,** Microbial Genetics

Course description: Introduction to genetics; heredity and variation; Mendelian genetics; Extensions to Mendelian genetics; chromosome theory and mapping; sex chromosomes and sex determination; genes that regulate development in selected model organisms; population genetics: allele frequencies, Hardy-Weinberg law, natural selection, genetic drift; and evolutionary genetics including speciation.

FOURTH YEAR COURSES

CHM3821 NATURAL PRODUCT CHEMISTRY I

Course Title:	**Natural Product Chemistry I**
Course Code	**CHM3821**
NQF Level	8
NQF Credits	8
Contact Hours	2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Continuous Assessment	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3752 (Organic Chemistry II), CHM3702 (Instrumental Analysis I)

Course Description: This course introduces students to the biosynthetic pathways and classification of secondary metabolites or natural products. Special emphasis will be placed on chemical structure and how it affects the physiological function of various natural products. The following will be covered. **Topics include:** Classification of natural products. Primary and secondary metabolites; NMR techniques in biosynthesis studies (^{13}C-NMR, isotope incorporation). Polyketide pathway: fatty acids, cyclization of polyketides to aromatics, skeletal types of polyketides. The shikimic acid pathway: biosynthesis of shikimic acid and aromatic amino acids, biosynthesis of phenylpropanoids and other metabolites from the shikimate pathway. Isoprenoids: biosynthesis of mevalonic acids, monoterpenes, sesquiterpenes, diterpenes, sesterterpenes, triterpenes, tetraterpenes and steroids.

CHB3831 BIOINFORMATICS FOR BIOCHEMISTRY

Course Title: **Bioinformatics for Biochemistry**
Course Code **CHB3831**
NQF Level 8
NQF Credits 16
Contact Hours 4 lecture periods per week and 1 practical session per week for one semester
Continuous Assessment **(**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1x3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite **CHB3731** (Bioenergetics and metabolism), **MBL3631** (Cell Molecular Biology and Genetics)
Course Descriptor: The development of rapid DNA sequencing techniques has led to an information revolution in molecular biology. Computer based technologies are therefore applied and employed in the management and analysis of such biological data. This course is a hand-on and inactive course in which students will acquire knowledge on information networks, the World Wide Web as a tool and resource for molecular biology. They will gain skills and knowledge in using these resources in sequence and structure analysis. The various genomic and proteomic databases and the levels of stored data will be discussed and applied in depth. This will lead to the identification of characteristic profiles, protein families, evolutionary relationships, etc. the module will also include the design of PCR and oligonucleotide primers for cloning and mutagenesis as well as identifying open-reading frames (ORFs) in nucleotide sequences. The course will consist of lectures, student presentations and assignments.

CHM3801 INSTRUMENTAL ANALYSIS II

Course Title: **Instrumental Analysis II**
Course Code **CHM3801**
NQF Level 8
NQF Credits 8
Contact Hours 2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Continuous Assessment **(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite CHM3702 (Instrumental Analysis I)
Course Descriptor: Separation methods; solvent extraction; introduction to chromatographic methods of separation; general description of chromatography. GC, GLC, LC, TLC, HPLC; qualitative and quantitative analysis by chromatography; high performance liquid chromatography, column efficiency and chromatographic mobile phases; partition chromatography; adsorption chromatography ion-exchange chromatography; size exclusion chromatography; planar chromatography; ^{13}CNMR spectra and ^{1}HNMR: 1-dimensional NMR (DEPT, NOE), 2 dimensional NMR (COSY, HETCOR, NOESY) theory, experimental methods and interpretation of spectra.

CHM3811 ORGANIC CHEMISTRY III

Course Title: **ORGANIC CHEMISTRY III**
Course Code **CHM3811**
NQF Level 8
NQF Credits 16
Contact Hours 4 lecture periods per week for one semester; 1 practical session per week for one semester
Continuous Assessment **(**minimum of three tests which counts 68%, laboratory component 20% and Quiz 12%). **Examination:** 1x3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite **CHM3752** (Organic Chemistry II)
Course Descriptor: Enolates: tautomerism, racemisation, halogenations, haloform reaction, Aldol reactions, Claisen-Schmidt reactions, addition to α,β-unsaturated systems. Carboxylic acids and their derivatives: preparations and reactions of acids, acyl chlorides, acid anhydrides, esters, lactones, amides and imides, lactams. β-dicarbonyl compounds: Claisen condensations, crossed Claisen condensations, "active hydrogen" synthesis , direct alkylations of esters and nitriles, simple and conjugate additions to α,β-unsaturated systems, Mannich reactions; Amines: preparations, reactions, Hofmann and Cope elimination reactions. Phenols: physical properties, preparations, O-reactions, C-reactions, rearrangements, nucleophilic aromatic substitutions. Selected examples of multistep synthesis of organic compounds.

CHM3810 RESEARCH PROJECT

Course Title: **Research Project**
Course Code **CHM3810**
NQF Level 8
Contact Hours: 2 consultation periods per week for one semester
NQF Credits 32
Continuous Assessment 1 Oral presentation counts 30%, Consultation and efforts counts 20%, 1 Project report counts 50% **Final: 100%** CA
Prerequisite Pass in all third year courses and at least one statistics course
Course Descriptor: An independent project carried out in small groups, under the supervision of a member of staff. Topics will be given to students before the end of the first semester. The work will extend over the term and as a guide, should occupy the equivalent of one whole day per week. The practical work must be completed by six weeks before the session ends and must be submitted by two weeks before the session ends . The completed report is expected to be between 25-35 pages long and will be examined by the supervisor and one external examiner and will be defended by an oral exam.

CHC3821 CLINICAL BIOCHEMISTRY

Course Title: **Clinical Biochemistry**
Course Code **CHC3821**
NQF Level 8
NQF Credits 8
Contact Hours: 2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
Continuous Assesment **(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite Bioenergetics and Metabolism (CHB 3731), Medicinal Chemistry I, (CHP3741), Drug discovery and development (CHP3721)

Course Descriptor: Biochemistry of Hormones: Blood and Transport Proteins, Hemostasis and Thrombosis. Bioenergetics and Oxidative Metabolism. Anaerobic Metabolism of Glucose in the Red Cell. Carbohydrate Storage: Synthesis in Liver and Muscles; obesity. Biosynthesis of Cholesterol in Liver. Special Liver Function. Muscle: Energy Metabolism and Contraction. Glucose Homeostasis and Fuel Metabolism. Water and Electrolyte Balance: Kidney Function. Diseases of the Lung and Kidneys: The Control of Acid-Base Balance. Calcium and Bone: osteoporosis; Metabolism. Neurochemistry. Neurotransmitters: psychosis and other nervous disorders Pathology: scientific investigation of the biology of human disease, 'Genes and the cell in health and disease' and 'Infection, Inflammation and immunity, Histochemistry, Immunocytochemistry. Oncology: Biochemical and molecular basis of cancer: Cell Cycle, Programmed Cell death, multistage nature of cancer, including the roles of the environment and somatic mutation, explore the known genetic mechanisms leading to cancer, Discuss approaches to targeted therapies for different cancers, current advances in HIV testing, diagnosis and treatment.

CHP3811 WASTE WATER TREATMENT

Course Title:	**Wastewater Treatment**
Course Code	**CHP3811**
NQF Level	8
NQF Credits	16
Contact Hours	4 lecture periods per week for one semester; 1 practical session per week for one semester
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHP3701 (Water Analysis), CHP3711 (Environmental Chemistry I)

Course Descriptor: The principles of coagulation, flocculation, sedimentation, filtration, biological treatment, solids handling, disinfection, and advanced treatment processes are presented. Physical and Chemical Processes for Water and Wastewater treatment. Biological Processes for Water and Wastewater treatment, characteristics, domestic versus industrial wastewater. Types of industries and their wastewater ,Sampling of wastewater Analysis of industrial wastewater. Examples of wastewater from different industries, BOD, COD, Toxicity, Heavy metals, Dissolved, suspended solids. Uses of water in industry.Cooling, conveying, process, boilers, water heaters, etc. Pretreatment of water for industrial use, Water pretreatment processes as sources of wastewater (Reverse Osmosis, softening, desalination, etc). Pretreatment of waste waters: equalization, settling, coagulation, filtration, pH adjustment, neutralization, flocculation, grit removal, treatment for sewer discharges, treatment for reuse. Agricultural reuse options, Community reuse options, Industrial reuse options. Chemical wastewater treatment: Coagulation, flocculation, precipitation, heavy metals removal, Oxidation, chlorination, other processes. Physical wastewater treatment: Reverse Osmosis, Activated charcoal, distillation / evaporation, Biological wastewater treatment, Elementary Microbiology. Nanotechnology **in waste water treatment: Nano filtration.**

CHP3822 ENVIRONMENTAL CHEMISTRY II

Course Title:	**Environmental Chemistry II**
Course Code	**CHP3822**
NQF Level	8
Contact Hours	2 lecture periods per week for one semester
NQF Credits	8
Continuous Assessment	**(**minimum of two tests which counts 70%, Student led discussions contributes 15%, Paper Review Proposal contributes 5%, Paper Review contributes 5% and Paper peer Review contribute 5%. **Final: 50%** CA mark and **50%** Examination mark
Prerequisite	Environmental Chemistry I (CHP3711)

Course Descriptor: Climate in the Spotlight: Spectrum of Scientific Opinion, Greenhouse Gases: An overview of the role of Carbon dioxide and Methane, Carbon dioxide reservoirs, Climate cycles: Determining the past climates, Climate change and Political realm, Relationships between Technological Innovation and Climate Change, Physical and Social Impacts of Climate Change, Climate Change Adaptation strategies, Implications of the introduction of new technologies for Adaptation and Sustainability, Current international efforts to address climate change.

CHP3842 MEDICINAL CHEMISTRY II

Course Title:	**Medicinal Chemistry II**
Course Code	**CHP3842**
NQF Level	8
NQF Credits	8
Contact Hours	2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Continuous Assessment	**(**minimum of three tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite:	CHM3811 (Organic chemistry III, **co-requisite**), CHP3741 (Medicinal Chemistry I, prerequisite), CHP3721 (Drug Discovery and Development, **prerequisite)**

Course Descriptor: Disease targeting, Assay Systems and Models (e.g., Knock-out Mice); molecular modelling; stereoselective synthesis; structural analysis of drugs; combinatorial synthesis; physico-chemical aspects and principles of drug action; anti-infective agents; anti-viral agents; antibacterial agents; cardiovascular agents; case studies: drug and drug targets in the pathogenesis of selected infectious diseases (malaria, HIV/AIDS, tuberculosis) and non-infectious diseases (cancer).

CHB3862 INDUSTRIAL PHARMACEUTICAL BIOTECHNOLOGY

Course Title:	**Industrial Pharmaceutical Biotechnology**
Course Code	**CHB3862**
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
Continuous Assessment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHP3721 **(**Drug discovery and development), CHB3722 (Transmission of Genetic Information)

Course Descriptor: Biotechnology and Medicine: Diagnostics, Therapeutics, Gene Therapy, Implantates, Medical Devices, Technology, Complex Traits; **Molecular Pharma-Biotechnology,** Bioinformatics, Biological Systems and Models, Assay Systems, High-throughput Screening, Automation, Combinatorial Synthesis: Chemistry, Biology, and Biotechnology, Genotyping: Genetic Pre-Disposition, and Heterogeneity, Sequencing, Pharmaco-Genomics **Pharmaceutical Production:** GenePharming (Animals and Plants); Vitamins , Amino Acids, Proteins, Antibiotics, Biocatalysis, Natural Compounds, Recovery/(Bio-) Processing, Chemical–

Biotechnological Syntheses, Gene Therapy Vectors/Systems, Production: Safety, Efficacy, Consistency, and Specificity, Registration; **Environment:** Pharmaceuticals and the Environment; Biological Containment; Physical/Chemical Containment, Process-Integrated Environmental Protection, Waste/Effluent Treatment and Recycling

CHN3842 HEALTH AND NUTRITIONAL BIOCHEMISTRY

Course Title:	**Health and Nutritional Biochemistry**
Course Code	**CHN3842**
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
Continuous Assessment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	**Bioenergetics** and Metabolism (CHB3731), Medicinal Chemistry (CHP3741)

Course Descriptor**: The following topics are covered: Digestion and Abs**or**ption:** digestive tract, secretion of digestive materials, stimulation of digestive system, molecules important to digestion and absorption, digestion of biomolecules. **Nutrients that resist** or **escape digestion**: resistance of proteins to digestion, carbohydrates that escape digestion, dietary fibers, microorganisms and digestion, malabsorption syndromes. **Obesity**: types of fat, techniques for measuring fat, signaling pathways for regulating adipocyte formation and genetic factors in obesity. **Diet and Cancer**: cancer of the large bowel, genetic changes that result in cancer, RAS and MAP kinase signaling pathway, mutations in the RAS gene and cancer, Cadherin proteins and Epidemiology of diet and colon cancer, Vitamins and inorganic nutrients.

CHM3822 NATURAL PRODUCT CHEMISTRY II

Course Title:	**Natural Product Chemistry II**
Course Code	**CHM3822**
NQF Level	8
NQF Credits	8
Continuous Assessment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3752 (Organic Chemistry II); **Co-requisite:** CHM3801 (Instrumental Analysis II)
Contact Hours	2 lecture periods per week for one semester; 1 practical session per week for 7 weeks

Course Description: Classification of alkaloids; alkaloids derived from ornithine, lysine, tyrosine, and tryptophan; pseudoalkaloids; metabolites of mixed biosynthetic origin. Extraction and purification of natural products: Phytochemical screening for different classes/groups of natural products. Bioassay-directed isolation of natural products. Determine the chemical structure of isolated compounds by applying IR, UV, one- and two-dimensional NMR and mass spectroscopy techniques.

CHB3842 BIOTECHNOLOGY, MICRO AND NANOTECHNOLOGY

Course Title:	**Biotechnology, Micro and Nanotechnology**
Course Code	**CHB3842**
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
Continuous Assessment	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final:** 50% CA mark and **50%** Examination mark.
Prerequisite	Transmission of Genetic information (CHB3722)

Course Descriptor**:** Introduction to "omics"; **Genomics**: techniques-genomic libraries and analysis, southern blots, applications. **Proteomics:** definitions, concepts of protein expression and analysis, Techniques-SDS PAGE gels, Western blots, applications. **Transcriptomics:** definitions, Techniques- cDNA libraries and analysis, Northern blots, applications. **Metabolomics:** Techniques-metabolic pathways and analysis. **Cytomics**: Biochemical processes at the cellular; **Agricultural Biotechnology:** Technology Studies: Pesticide producing crops; Herbicide-tolerant transgenic crops; Insect-resistance transgenic crops. **Micro- and Nanotechnologies for Medicine**: Scope, principles and techniques of nanotechnology; preparation of nanoparticles and their properties, application of nanotechnology in biotechnology: Oligonucleotide microarray, 'lab-on-a-chip' nanocomposites; Cellular Cloning; Tissue Engineering (Organ Cultivation); Food **Biotechnology:** Enzyme application in food and feed; probiotics - prebiotics and nutraceuticals.

CHM3802 INORGANIC CHEMISTRY III

Course Title:	**Inorganic Chemistry III**
Course Code	**CHM3802**
NQF Level	8
Contact Hours:	2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
NQF Credits	8
Continuous Assessment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3751 (Inorganic Chemistry II), CHM3752 (Organic Chemistry II)

Course Descriptor**:** Organometallic chemistry: organometallic compounds of d block elements with emphasis to iron complexes; Physical and chemical properties of organometallic compounds; Reactivity of coordinated cyclopentadienyl and cyclobutane ligands. Transition metal carbonyls: metal clusters, bonding and synthesis; Catalysis involving organometallic compounds.

CHC3832 CHEMICAL XENOBIOTICS & TOXICOLOGY

Course Title:	**Chemical Xenobiotics & Toxicology**
Course Code	**CHC3832**
NQF Level	8
NQF Credits	16
Contact Hours	4 lecture periods per week; 1 practical session per week for one semester
Continuous Assessment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHP3701 (Water Analysis), CHP3711 (Environmental Chemistry I)

Course Descriptor: this module is designed to study the interactions between environmental contaminants and living organisms. It looks at the behavior of xenobiotics into living organisms particularly the biotransformation reactions and reactive species formation and it also looks at the effects that chemical xenobiotics can cause in biological processes.
Content: Chemical Xenobiotics: Classification and behaviour . Bioaccumulation and biomagnification of xenobiotics. Behavior of xenobiotics into living organisms: absorption, distribution, biotransformation, toxic effects and elimination. The fate and impact of synthetic and natural molecules in the environment. Important pollutants will be used as case studies to illustrate the principles. Principles of toxicology; chemical and biochemical mechanism; pesticide toxicity. Analysis of specific health and environmental impact of hazardous waste.

CHC3822 Petroleum Chemistry

Course Title:	**Petroleum Chemistry**
Course Code	**CHC3822**
NQF Level	8
NQF Credits	8
Contact Hours	2 lectureperiods per week; 1 practical session per week for 7 weeks
Continuous Assesment:	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3752 (Organic ChemistryII), CHM3761 (Industrial Chemistry I), CHM3712 (Physical Chemistry II)

Course Descriptor: Introduction: native materials and classification, properties and fractional composition. **Petroleum analysis**: structure of petroleum; physical, thermal, electrical, optical, spectroscopic, chromatographic and molecular methods. **Refining processes**: dewatering and desalting, thermal methods, catalytic methods, reforming, isomerization, alkylation and polymerization processes. **Cracking processes**: thermal cracking, catalytic cracking, hydrocracking. **Distillation**: equipment and calculation. **Product improvement**: deasphalting and dewaxing, hydrotreating and desulfurization, reforming and isomerization, petrochemical. Hydraulic fracturing in petrochemical industry. **Applications of Nano technology in Petroleum industry.**

CHM3880 RESEARCH METHODOLOGY & PROJECT

Course Title:	**Research Methodology & Project**
Course Code	**CHM3880**
NQF Level	8
Contact Hours:	2 consultation periods per week for one semester
NQF Credits	38
Continuous Assessment	1 Oral presentation counts 30%, Consultation and efforts counts 20%, 1 Project report counts 50% **Final: 100%** CA
Prerequisite	Pass in all level 7 modules

Course Descriptor: An independent project carried out in small groups, under the supervision of a member of staff. Topics will be given to students before the end of the first semester. The work will extend over the term and as a guide, should occupy the equivalent of one whole day per week. The practical work must be completed by six weeks before the session ends and must be submitted by two weeks before the session ends . The completed report is expected to be between 25-35 pages long and will be examined by the supervisor and one external examiner and will be defended by an oral exam. There shall be a short, block-course based, where the essentials of Research Methodology will be taught.

BLG3810 RESEARCH PROJECT

Course title:	**RESEARCH PROJECT**
Code:	**BLG3810**
NQF level:	8
Contact hours:	Research project for one year
Credits:	32
Course assessment:	Continuous assessment: 100% (Oral presentation of research proposal – 10%; written research proposal – 20%, oral presentation of results – 20%, written research report - 50%)
Prerequisites:	**BLG3702** Research Methodology

Course description: This course is designed to develop the research skills of students through the completion of a research project on an approved topic in the context of the major. Students will be expected to develop a research proposal with the guidance of the supervisor, present this proposal both orally and in writing, collect and analyze data using appropriate statistical tests, present the findings both orally and in the form of a research report; the report should be between 20 and 30 pages (Times New Roman 12 pt, 1.5 line spacing) and include a statement of the research problem, literature review including recent journal resources, objectives and hypotheses, methodology, results & data analysis, conclusion.

MBL3811 IMMUNOLOGY

Course title:	**IMMUNOLOGY**
Code:	**MBL3812**
NQF level:	8
Contact hours:	4 lecture periods per week and 3 hour practical per week for one semester
Credits:	16
Course assessment:	Continuous assessment 40% (10 graded practicals, minimum of 2 tests and 1 assignment) Examination 60% (3 hour exam paper)
Prerequisites:	**MBG 3711** Microbial Genetics
Co-requisite:	**MIC3842 Virology**

Course description: Theory: The course will introduce the immune system by addressing processes and components such as: immunoglobulin classes, structure and functions of antibody molecules, lymphoid organs, antigen processing, cells involved in the immune system, T-cell receptors, Major-Histocompatiblity Complexand complement pathways. Different types of immunity such cellular mediated immunity, humoral immunity and autoimmunity will also be addressed in the course. Various human diseases caused by viruses, bacteria and parasites such as HIV/AIDS tuberculosis and malaria will then be discussed in order to give an applied perspective of immunology. Related aspects like vaccination and drug efficacy will also be covered as complementary components of the course. Contemporary issues pertaining to immunology such as gene therapy, and stem cell research will also be looked at.**Practical:** Preparation of serum from whole blood, Doing the Enzyme Linked Immono-Sorbent Assays (ELISA) Doing Agglutination Tests, Antibody Conjugation Assays, Inoculation of laboratory animals and monitoring of antibody titre.

MIC3811 MYCOLOGY

Course title: **MYCOLOGY**
Code: **MIC3811**
Course Equivalent: None
NQF level: 8
Contact hours: 4 lecture periods / week for one semester and one three hour practical session per week per semester
Credits: 16
Course assessment: Continuous assessment: **40%** Theory (not less than 2 tests and 2 assignments), Practicals (not less than 10 marked assignments) Examination: **60%** (1 x 3 hour examination paper)
Prerequisites: **MBG 3711 Microbial Genetics**
Co-requisite: **MIC 3842, Virology; MIC3852, Parasitology,**
Course description: This course will deal with concepts and applications of mycology. Topics will include Morphology, genetics, classification, ecology, and economic importance of Imperfect Fungi, Oomycetes, and Zygomycetes. Emphasis in the laboratory is on isolation, culture, and laboratory techniques. A survey of those fungal classified as Ascomycetes (such as yeasts, morels, powdery mildews and as Basidiomycetes (such as rusts, smuts, boletes, mushrooms, polypores). Emphasi in the laboratory is on anatomy and morphology as well as field identification of diseases affecting trees in the forest and forest nursery. Emphasis is on field identification using symptoms exhibited by disease trees and characteristics of the pathogens. This course is intended to introduce the student to a quite diverse group of organisms and the many roles that they play in everyday life. The fungal kingdom and other organisms traditionally considered as fungi profoundly impact humans and the environment in both positive and negative ways. Certain fungi are responsible for production of food, while others have been responsible for devastating famines. Fungi have led to great advances in the treatment of infections through the discovery of antibiotics yet some fungi are the agents that cause many serious illnesses, especially among immuno-compromised patients. One of the most important roles that fungi play is that of recycler of organic material, which reduces complex molecules to simpler ones that can be re-used by other organisms. The course will involve group discussions of recent papers in mycological journals. This course will also include excursions to industries and the lectures will be given in a highly interactive manner.

MIC3862 MEDICAL BACTERIOLOGY

Course title: **MEDICAL BACTERIOLOGY**
Code: **MIC3862**
NQF level: 8
Contact hours: 2 lectures per week for one semester and one 3-hour practical session every second week for one semester.
Credits: 8
Course assessment: Continuous assessment (40%): Theory (not less than 2 tests and 2 assignments); Practicals
Examination (60%):(1 x 2 hour examination paper)
Prerequisites: **MBG3711** Microbial Genetics
Co-requisite **MIC3811** Mycology
Course description: This is an applied course equivalent to Clinical Microbiology or Diagnostic Microbiology. It will start with a discussion of the purpose and philosophy of medical bacteriology, laboratory safety, laboratory organization, quality control and assessment, sterilization and disinfection, managing a microbiology laboratory, handling clinical/bacteriological specimens. The course will then look at normal microbial flora versus pathogens, morphology and taxonomy, optical methods for laboratory diagnosis of infectious disease, cultivation and isolation of viable pathogens, conventional and rapid microbiological methods for identification of pathogens. Non-traditional methods for identification and detection of pathogens or their products (particle agglutination, ELISA, flourogenic substrates, genetic probes, blotting techniques, and PCR).

MIC3852 PARASITOLOGY

Course title: **PARASITOLOGY**
Code: **MIC3852**
NQF level: 8
Contact hours: 4 lecture periods and 1x3hour practical period per week for one semester
Credits: 16
Course assessment: Continuous assessment **40%:** Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment)
Examination **60%:** 1x3 hour theory paper
Prerequisites: **MBG3711** Microbial Genetics
Co-requisite **MIC3811** Mycology**, MIC3862** Medical Bacteriology
Course description: Parasites will be studied based on life cycles, host specificity, parasite biochemistry, molecular parasitology and parasites behavior. There will be a substantial basic introduction to endoparasites, ectoparasites, obligate parasites, facultative parasites as well as host-parasite interaction aspects such as symbiosis, commensalisms and mutualism. Zoonoses (diseases transmitted between animals and humans): Rabies and Hantavirus syndromes. Arthropod transmitted diseases: Rickettsial diseases, Lyme disease, West Nile virus, Plaque and others will constitute an important component of the course. The course will also address Veterinary Parasitology to discuss those parasites that are causing economic losses in agriculture or which infect companion animals such as Trypanosomiasis and Leishmaniasis. The general life cycle of arthropods which are main vectors of parasites such as ticks, fleas and locusts will be discussed. The course will also cover integrated pest management. The practical content will include: identification and isolation of endo-parasites using Glucose Flotation Method/Sedimentation. Microscopic preparation and examination of blood parasites. Identification of ectoparasites based on morphological characteristics.

EBL3812 BEHAVIOURAL ECOLOGY

Course title: **BEHAVIOURAL ECOLOGY**
Code: **EBL3812**
NQF level: 8
Contact hours: 4 lecture periods per week, 3 hour practical per week for one semester
Credits: 16
Course assessment: Continuous Assessment 40%: (at least 10 assessed practicals, 2 tests)
Examination 60%: (1x 3 hours theory paper)
Pre-requisites: **EBL3712** Ecosystem Ecology or only **EBE3772** for education students

Course description: This course will introduce students to the role of behavior in understanding the ecology of organisms. Special emphasis will be given to the genetic basis of behavior, how behavior evolved (phylogeny) as well as how it develops in organisms (ontogeny). These will provide a foundation to understand learned and innate behavior and how behavioral ecology is instrumental in applied ecology disciplines such as conservation biology. Any student who does not take part in the field course in EBL3800 Field Ecology II will NOT be allowed to sit the examination. Introduction: definition of behavior, nervous system and behavior, simple (reflexes) and complex behavior. Development (Ontogeny) of behaviour: nature and nurture, instinct and learning in their biological setting, maturation-development involving growth, hormones and early development, play, imprinting and early experience. Evolution (Phylogeny) of behaviour: natural selection and behaviour, genetic basis of behaviour, the adaptiveness of behaviour, ritualisation. Diversity of behaviour: Innate behaviour, innate releasing mechanisms, fixed action patterns. Learned behaviour: habituation, conditioned reflex Type 1, trial & error learning, latent learning, insight learning. Communication: definition, evolution and use of signals in communication, information content of signals e.g. honey bees, manipulation in communication, cost, honesty/deceit & handicaps. Sex and sexual selection, advantages of sex (why two sexes), selection on males and females, Mate choice (male/female competition and female/male choice), Intra-and inter-sexual selection, sperm competition and mate guarding. Feeding and anti-predator behaviour: Feeding behaviour, diversity of prey capture techniques (prey detection and capture), optimal foraging behaviour, costs & benefits, optimality models, constraints in foraging efficiency; Anti-predator behaviour: detection of predators, chemical defenses, warning colouration, mimicry, alarm signals, improved vigilance, selfish herd effect. Dilution effect; Social organisation; group living (advantages), types of mating systems (e.g. polyandry, polygyny, monogamy, lek), social dominance, cooperation, aggression, altruism, parental care, territoriality , primate social organisation, insect social organisation.

MIC3842 VIROLOGY

Course title:	**VIROLOGY**
Code:	**MIC3842**
NQF level:	8
Contact hours:	2 lecture periods/week for one semester and one 3 hour practical session every second week for 1 semester
Credits:	8
Course assessment:	Continuous assessment 40%: Practicals (at least 6 assessed practicals), Theory (2 tests) Examination 60%: 1x2 hour theory paper
Prerequisites:	**MBG3711** Microbial Genetics
Co-requisite	**MIC3811** Mycology

Course description: This course will deal with exciting concepts of virology and is intended to provide students with the latest information in virological methods and provide advanced knowledge. Topics will include an introduction to viruses, their nature and structure. Nomenclature, classification and diversity and evolution of viruses. Principal events involved in replication: Adsorption, penetration, disassembly, nucleic acid and protein synthesis, assembly, maturation and release. Replicative strategies employed by selected DNA and RNA viruses. Identification of virus prototypes associated with different RNA and DNA virus replication schemes. Viral pathogenesis and treatment using examples of common and emerging viruses. Throughout the virologycourse, emphasis on those infectious diseases that are of great actual or potential importance to humans should be made

MIC3831 ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY

Course title:	**ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY**
Code:	**MIC3831**
NQF level:	8
Contact hours:	4 lecture periods / week for one semester and one 3-hour practical session every second week for one semester.
Credits:	16
Course assessment:	Continuous assessment **40%** (minimum of 2 tests and 2 Assignments as well as 10 assessed practicals) Examination **60%**: (1 x 3 hour examination paper)
Prerequisites:	**MBL3701** Recombinant DNA Technology

Course description: Industrial fermentation: Bioprocess development- isolation and screening of target organisms, strain selection, strain improvement, master culture preservation, media design, scale-up, fermentation vessels, oxygen transfer rate, bioprocess control, downstream processing. Batch culture, fed-batch culture, continuous culture, Crabtree effect, Pasteur effect. Production of antibiotics (eg.Penicillin), vaccines (eg. hepatitis B vaccine), beer, amino acids (eg.Lysine, glutamate), organic acids (eg.Citric acid) and vitamins (eg. ascorbic acid), algal cultures.Design, operation and monitoring of a facility for manufacture of sterile products.Bioconversions, biodegradation, bioleaching.Factors that may influence sterility in manufacturing.**Environmental microbiology**: The role of microorganisms in the Environment. Terrestrial Environment: soils. Soil microorganism associations with plants.Marine Environment and Freshwater Environment. Sewage treatment: Conventional sewage and wastewater treatment, anaerobic digesters, constructed wetlands, septic tanks. Analysis of water purity.Indicator organisms, biocontrol, Baculovirus as a control agent, biomining, bioremediation, biostimulation, bioaugmentation.

MBL3801 BIOINFORMATICS

Course title:	**BIOINFORMATICS**
Code:	**MBL3801**
NQF level:	8
Contact hours:	2 Lectures per week for one semester + 3h practical every second week for one semester
Credits:	8
Course assessment:	Continuous assessment: **40%** (3 tests – 60% + at least 10 practical marks – 40%) Examination: **60%** (1 x 3h examination paper)
Prerequisites:	**MBL3732** Genetics,

Course description: The development of rapid DNA sequencing techniques has led to an information revolution in molecular biology. Computer based technologies are therefore applied and employed in the management and analysis of such biological data. This course is a hand-on and interactive course in which students will acquire knowledge on information networks, the World Wide Web as a tool and resource for molecular biology. They will gain skills and knowledge in using these resources in sequence and structure analysis. The various genomic and proteomic databases and the levels of stored data will be discussed. The information retrieval and analysis tools such as sequence similarity and alignment will be discussed and applied in depth. This will lead to the identification of characteristic profiles, protein families, evolutionary relationships, etc. The course will also include the design of PCR and oligonucleotide primers for cloning and mutagenesis as well as identifying open-reading frames (ORFs) in nucleotide sequences The course will consist of lectures, student presentations and assignments.

MOL3822 APPLIED GENETICS

Course title: **APPLIED GENETICS**
Code: **MOL3822**
NQF level: 8
Contact hours: 2 Lectures per week for one semester 3h practical every second week for one semester
Credits: 8
Course assessment: Continuous assessment **40%:**5 graded practicals; 2 theory tests. Examination **60%:** 1x2 hour theory paper.
Prerequisites: **MBG3711** Microbial Genetics, **MBL3701** Microbial Ecology**, MBL3712** Biotechnology**, MBL3732** Genetics

Course description: This is a senior undergraduate course designed to allow students to conceptualise the applications of genetics in dealing with day to day situations in agriculture, medicine and the environment. This course will deal with exciting concepts in genetics. Topics will include: Introduction, aims of Applied Genetics, revision of basic genetic concepts and terminology; the inheritance and analysis of qualitative and quantitative characters; regression, transgression, environmental effects and heritability; correlations between characters; genotype, phenotype and breeding values; population genetics: allele frequencies, genetic equilibria, population mixing, genetic drift and gene flow; types and uses of selection; departures from random mating; mutation and its uses; recombination and mapping; structural chromosome aberrations: their origins, properties and uses; changes in chromosome number: their effects and uses; supernumerary ("B") chromosomes; breeding methods and examples; human and medical genetics; genetic engineering in plants, animals and microorganisms , and human gene therapy; genetic variation in wild and agricultural populations, genetic conservation; genetic methods of insect pest management; applied fungal genetics; ethics.

EBL3822 ENTOMOLOGY

Course title: **ENTOMOLOGY**
Code: **EBL3822**
NQF level: 8
Contact hours: 2 lecture periods / week and 1x3hour practical sessions every second week for one semester
Credits: 8
Course assessment: Continuous assessment: **40%;** practicals (at least 5 graded practicals), at least 2 tests, and 10% of CA for insect collection/identification project. Examination **60%:** 1x2 hour theory paper
Prerequisites: **EBL3722** Biosystematics II

Course description: Introduction to entomology; Why study entomology. Structure: segment morphology; internal and external insect structures; Physiology: insect growth, development and physiology; Insect senses and behavior (including communication); pheromones.Insect diversity: Common insect Orders and their representatives; Orthoptera; Isoptera Hemiptera; Neuroptera; Coleoptera; Diptera; Lepidoptera; Hymenoptera. Pests and beneficial insects, key pests in Namibia, secondary pests; insects as vectors of disease; insect vector-parasite relations; secondary plant metabolites and plant-insect relationships; economic damage.Pest management, Crop protection methods; Integrated Insect Pest Management (IIPM).

MIC3872 DEVELOPMENTAL BIOLOGY

Course title: **DEVELOPMENTAL BIOLOGY**
Code: **MIC3872**
NQF level: 8
Contact hours: 4 lecture periods / week for one semester and 1x3hour practical sessions per week for one semester
Credits: 16
Course assessment: Continuous assessment **40%** (minimum of 2 tests and 2 Assignments)
Examination **60%** (1 x 3 hour examination paper)
Prerequisites: **MBL3732** Genetics, **MBL3771 Physiology** Only **MBE3771**- for education students

Course description: Thiscourse is designed to provide students with an understanding and appreciation of the complex processes of plant growth and development from a molecular perspective. The course will examine the characteristics of plant growth, with emphasis on the meristematic nature of this growth and growth kinetics, as well as the advantages and disadvantages of different growth parameters. The process of growth will be discussed from a physical perspective taking into account Heyn's concept of cell wall extensibility, the role of pH and expansions, cell growth & water stress and the need for solutes. A number of developmental control mechanisms will be considered with emphasis on the interdependency between genetic, hormonal and environmental control mechanisms, as well as signal perception and transduction. The role of the six classes of plant hormones in the regulation of cell division, cell enlargement, cell differentiation, seed development, shoot & root development, senescence and abscission, as well as flower and fruit development will be investigated, mainly from results obtained from mutagenic studies. The course will further examine the structure, characteristics and functions of phytochrome, cryptochrome and phototropin with emphasis on photocontrol of seed germination, the processes of etiolation & de-etiolation, canopy shading & end-of-day signals and photoreceptor signal transduction. The course will conclude with an investigation of flowering by considering aspects such as floral induction and floral development. Animal growth, including the genetic control of cell growth, differentiation and morphogenesis, development of the gametes, fertilization, all stages of pre-embryonic and post-embryonic development. The two developmental paths followed by animals namely regulative development and mosaic development will be discussed. Aging: Telomere-deletion hypothesis, wear-and-tear hypothesis, Gene-clock hypothesis, accumulated mutation hypothesis and effects of various physiological and Environmental factors affecting these processes. Cancer: cell-cycle regulation and genetics of cancer, causes and development of cancer. Stem cells: embryonic stem cells, somatic stem cells, therapeutic stem cell cloning etc. Animal tissue culture and Cloning: tissue culture techniques, tissue culture media, cloning.

MIC3800 INTERNSHIP

Course title: **INTERNSHIP**
Code: **MIC3800**
NQF level: 8
Contact hours: This course will provide opportunities for students to spend 4 weeks at various university laboratories, research institutions and industries in order to gain hands-on experience. Students can choose any time during the year to do their internship, as long as it does not interfere with their classes or practicals.
Credits: 8
Course assessment: Continuous assessment **(100%).** Students will be graded based on comprehensive reports which they must submit upon the completion of the internship. In addition a report based on a standard format designed by the department will be submitted by the supervisors of the student during the internship.
Prerequisites: **BLG3702** Research Methodology

Course description: During the internship period students will be attached to different relevant scientific institutions in Namibia, in the SADC region as well as identified institutions in other African countries. Students will have to participate in projects and programs which are carried out at the respective institutions. Attached students are also obliged to attend scheduled events such as seminars, tours and lectures at the institutions. Although the department will identify some relevant institutions, the students may suggest institutions of their choice as long as they are in agreement with the department. The type of skills to be learned through the internship will be decided by the students themselves based on their interests.

BLG3880 RESEARCH METHODOLOGY AND PROJECT

Course title: **RESEARCH METHODOLOGY AND PROJECT**
Code: **BLG3880**
NQF level: 8
Contact hours: Research project for one year
Credits: 38
Course assessment: Continuous assessment: 100% (Oral presentation of research proposal – 10%; written research proposal – 20%, oral presentation of results – 20%, written research report - 50%).
Prerequisites: **BLG3702** Research Methodology
Module Description: This module is designed to develop the research skills of students through the completion of a research project on an approved topic in the field of Environmental Biology / Microbiology. Students will be expected to develop a research proposal with the guidance of the supervisor, present this proposal both orally and in writing, collect and analyze data using appropriate statistical tests, present the findings both orally and in the form of a research report; the report should be between 20 and 30 pages (Times New Roman 12 pt, 1.5 line spacing) and include a statement of the research problem, literature review including recent journal resources, objectives and hypotheses, methodology, results & data analysis, conclusion, and recommendations. Students will undergo a two weeks review of the following aspects of research methods to assist them in the drafting, conducting and write up of their Honors Research project reports:- Ethics of research; the Scientific method including hypotheses; sampling techniques and methods; scientific writing (literature review, research proposal) and presentation of scientific findings. The review will take the form.

D.1.13 BIOCHEMISTRY, MICROBIOLOGY & BIOTECHNOLOGY MODULE EQUIVALENTS

BIOCHEMISTRY PROGRAMMES:

OLD MODULE		**NEW/REVISED MODULE**	
CHB3611	Biochemistry I	CHB3612	Biomolecules and Catalysis
CHB3612	Biochemistry II	CHB3612	Biochemistry II
CHB3701	Biochemistry III	CHB3722	Transmission of Genetic Information
CHM3722	Research Methodology	CHM3722	Research Methodology
CHB3732	Medicinal Biochemistry	CHB3732	Medicinal Biochemistry
CHB3801	Nutritional Biochemistry	CHB3801	Nutritional Biochemistry
CHB3831	Bioinformatics for Biochemistry	CHB3831	Bioinformatics for Biochemistry
CHB3812	Environmental Biochemistry	CHB3812	Environmental Biochemistry
CHB3852	Advanced Topics in Biochemistry		**NONE**
CHM3810/CHB3810	Research Projects	CHM3810/ CHB3810	Research Projects

MICROBIOLOGY PROGRAMME:

YEAR	**SEMESTER**	**OLD MODULES**		**EQUIVALENT NEW COURSE**	
1	**1**	BLG3511	Introduction to Biology	BLG3511	Introduction to Biology
	2	BLG3512	Diversity of Life	BLG3512	Diversity of Life
2	**1**	BLG3611	Animal Form and Function	BLG3611	Animal Form and Function
		MBL3631	Cell Molecular Biology and Genetics	MBL3631	Cell Molecular Biology and Genetics
		STS3621	Statistics for Life Sciences I	BLG3621	Biometrics I
	2		None/New Course	MBL3611	Microbial Systematics
		MBL3632	Introduction to Microbiology	MBL3632	Introduction to Microbiology
		STS3622	Statistics for Life Sciences II	BLG3622	Biometrics II
3	**1**		None/New course	BLG3701	Microbial Ecology
		MBL3752	Comparative animal physiology		No equivalent student has to repeat module
		MBL3751	Plant physiology		No equivalent student has to repeat module
			NONE	MBL3771	Physiology
		MBL3711	Microbiology	MBG3711	Microbial Genetics
		MBL3731	Recombinant DNA Technology		No equivalent student has to repeat module
	2		**NONE**	EBL3721	Biosystematics I
		MBL3712	Biotechnology	MBL3712	Biotechnology
		MBL3732	Genetics	MBL3732	Genetics
		BLG3702	Research Methodology	BLG3702	Research Methodology
			NONE	EBL3722	Biosystematics II
	1	BLG3810	Research Project	BLG3810	Research Project
			NONE	MIC3800	Internship
		MIC3812	Environmental and Industrial Microbiology	MIC3831	Environmental & Industrial Microbiology
		MIC3811	Mycology	MIC3811	Mycology
		MOL3811	Bioinformatics		No equivalent student has to repeat the module
			NONE	MBL3801	Bioinformatics

4		EBL3831	Biosystematics		No equivalent student has to repeat the module
		MBL3811	Immunology	MBL3812	Immunology
		MBL3831	Applied Molecular Biology		No equivalent students have to repeat the module
	2	MIC3832	Virology		No equivalent student has to repeat module
			NONE	MIC3842	Virology
		MIC3822	Medical Microbiology	MIC3862	Medical Bacteriology
		MOL3812	Applied Genetics		No equivalent student has to repeat module
					No equivalent student has to repeat module
			NONE	MIC3802	Parasitology
			NONE	MIC3872	Developmental Biology
		MOL3852	Animal growth and development		No equivalent student has to repeat module
		MOL3832	Plant growth and development		No equivalent student has to repeat module

D.2 SERVICE COURSES

MBE3771 CELL MOLECULAR BIOLOGY, MICROBIOLOGY AND GENETICS FOR EDUCATORS

Course Title: **CELL MOLECULAR BIOLOGY, MICROBIOLOGY AND GENETICS FOR EDUCATORS**
Code: **MBE 3771**
Course equivalent: **MBE3771**
NQF level: 7
Contact hours: 4 lecture periods / week for one semester and 1x3hour practical session per week for one semester
Credits: 16
Course assessment: Continuous assessment **40%** (minimum of 2 tests and 2Assignments) Examination **60%** (1 x 3hour examination paper)
Prerequisites: **BLG3612** Plant Form and Function, **BLG3611** Animal Form and Function

Course description: This is a broad based course that will start with an introduction to the chemical basis of cellular processes, an overview of mitosis and meiosis, Mendelian & non-Mendelian Genetics: monohybrid crosses, dihydrid cross, test crosses, chromosomal theory of inheritance, sex determination & sex-linked genes, basic genetic linkage and chromosome mapping, and the genetic code; structure and function of eukaryotic chromosomes and mutations as the basis for genetic variations and their effects and natural selection. Macromolecules : proteins, carbohydrates fatty acids and nucleic acids and their roles in cellular organization; the structure of DNA and genome sizes and complexity; DNA replication; Eukaryotic transcription and RNA processing. The course will include principles of microbiology, importance of microorganisms, microbial cell structure, physiological diversity of microorganisms, prokaryotic diversity, microscopy and cell morphology, microbial cell membranes and cell walls, surface structures and inclusions, endospores, microbial motility and bacterial taxis, staining techniques, microbial nutrition and metabolism, culture media, laboratory culture of microorganisms, enrichment and isolation, isolation of pure cultures, bacterial cell division, growth of bacterial populations, measuring microbial growth, environmental effects on microbial growth, control of microbial growth, Identification of bacteria; Microbial genetics and genetic engineering: conjugation, transformation and transduction; Mutations, causes and uses of mutations; DNA Isolation; molecular cloning, genetic recombination, detection of variation in proteins and DNA. Genetically Modified Organisms: examples, risks and benefits.

D.3. B.SC IN BIOCHEMISTRY (HONOURS) 11BSAB & BSC MICROBIOLOGY (HONOURS) 11BMBA PROGRAMMES

D.3.1. PURPOSE AND RATIONALE OF THE QUALIFICATIONS

The purpose of this qualification is to provide an opportunity for holders of level 7 NQA degrees in Biochemistry/Microbiology or pre-NQF BSc degree in Biochemistry/Microbiology to upgrade to NQA level 8 honours degree. This programme will provide students with knowledge, skills and competence in the science of Biochemistry/Microbiology at BSc NQF Level 8 in order to develop Namibia's own human resources and capacity in Biochemistry/Microbiology.

For Biochemistry students, this program will facilitate students' progression towards fulfilling and exciting careers in academia, industry (food, beverage and diagnostic), and/or government and also to develop their skills as future leaders in science and society. Microbiology graduates from this Programme will be well trained and will be able to fit into various employment sectors namely, biomedical, human health, biotechnological, scientific research, agricultural, genetics, and environment sectors.

The programme is in line with UNAM's mission "To provide quality higher education through teaching, research and advisory services to our customers with the view to produce productive and competitive human resources capable of driving public and private institutions towards a knowledge-based economy, economic growth and improved quality of life."

D.3.3. ADMISSION REQUIREMENTS

The applicant must be in a possession of either

a) a BSc degree in Biochemistry/Microbiology at NQL level 7.

Or

b) Pre-NQF BSc degree in Biochemistry/Microbiology or any equivalent qualification from a recognized institution.
c) Students who have completed a double major BSc degree may be required to register for a number of undergraduate modules for non-degree purposes in order to gain admission into this programme.

D.3.4. ASSESSMENT CRITERIA

A combination of continuous assessment (50%) and an examination (50%) will be used to assess each of the typical modules in this program and details are further specified under respective modules. The minimum CA mark that will allow entrance into the examination is 50% and the minimum final mark of 50% is required for a pass. Assessment criteria are based on written examinations, written tests, assignments, laboratory practicals, research reports, oral examinations, and seminar presentations. Attendance of lectures and practical classes is compulsory (at least 80%).

D.3.5. MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE FACULTY

To be re-admitted to the Faculty of Science for a second year of registration, a student must have passed a minimum of 64 credits by the end of the first year.

D.3.6. ADVANCEMENT AND PROGRESSION RULES

Not applicable as this is a one-year programme.

D.3.7. DURATION OF STUDY

The minimum duration of the study is one year and the maximum is two years for full-time students and three (3) years for part-time students. Relevant committees may grant an extension of registration up to six (6) months beyond the stipulated period if valid reasons are advanced.

D.3.8. REQUIREMENTS FOR QUALIFICATION AWARD

This qualification will be awarded to candidates who have cleared all prescribed modules as indicated in the curriculum framework.

D.3.9. EXEMPTIONS

UNAM will give exemptions for equivalent courses taken at other tertiary institutions but the exemptions shall not exceed 50% of the programme in line with the General Information and Regulations Prospectus.

D.3.10. CLASS ATTENDANCE

In order to be admitted to examinations, students are required to attend at least 80% of the lectures and to complete the required elements that make up the continuous assessment mark. Hundred percent attendance of practical classes are required.

D.4. BACHELOR OF SCIENCE IN BIOCHEMISTRY HONOURS: 11BSAB

QUALIFICATION: B.SC. IN BIOCHEMISTRY HONOURS 11BSAB

Students opting for the 1 Year BIOCHEMISTRY HONOURS programme must take all of the following courses:

COURSE CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITE	CO-REQUISITE
FIRST SEMESTER					
CHB3831	Bioinformatics for Biochemistry	8	16	CHB3711, MBL3631	none
CHB3880	Research Methodology & Project	8	38	Pass in all level 7 modules	none
CHP3811	Wastewater Treatment	8	8	CHP3701, CHP3711	None
CHM3821	Natural Product Chemistry I	8	8	CHM3752, CHM3702	none
CHC3821	Clinical Biochemistry		8	CHP3721,CHP3731, CHB3731	none
SECOND SEMESTER					
CHB3842	Biotechnology, Micro and Nanotechnology	8	8	CHB3722	none
CHB3862	Industrial Pharmaceutical Biotechnology	8	8	CHB3722, CHP3721	none
CHN3842	Health and Nutritional Biochemistry	8	8	CHB3731,CHP3741	none
CHC3832	Chemical Xenobiotics & Toxicology	8	16	CHP3711, CHP3701	none
CHM3822	Natural Product Chemistry II	8	8	CHM3752	CHM3801
Total credits			**134**		

D.5. BACHELOR OF SCIENCE MICROBIOLOGY HONOURS: 11BMBA

TABLE FOR ALL MODULES IN THE PROGRAMME

Module code	Module name	NQF Level	Credits	Contact Time	*(Co-requisite) / Pre-requisite
Semester 1					
MIC3831	Environmental & Industrial Microbiology	8	16	4L 1P	MBL3732 / MBG3711, MBL3701
MIC3811	Mycology	8	16	4L 1P	MIC3842, MIC3852 0R MIC 3872 / MBL 3711
MBL3801	Bioinformatics	8	8	2L1P/T (once fortnight)	MBL3732
Total Credits Semester 1			**40**		

Module code	Module name	NQF Level	Credits	Contact Time	*(Co-requisite) / Pre-requisite
Semester 2					
MOL3822	Applied Genetics	8	8	2L1P/T (once fortnight)	MBL3701, MBL3712, MBL3732, MBG3711
MIC3852	Parasitology	8	16	4L 1P	MIC3811, MIC3862 / MBG3711
MIC3872	Developmental Biology	8	16	4L 1P	MBL3732, or MBE 3771 and MBL3771
MIC3862 MIC3842	Medical Bacteriology OR Virology	8 8	8 8	2L1P/T (once fortnight) 2L1P/T (once fortnight)	MIC 3811, MIC3842, MIC3852 / MBG3711 MIC3811, MIC3852, MIC3862 / MBG3711
Total credits Semester 2			**48**		

Module code	Module name	NQF Level	Credits	Contact Time	*(Co-requisite) / Pre-requisite
Full Year Modules Semester 1 & 2					
MIC3800	Internship	8	8		BLG3702
BLG3880	Research Methodology and Project	8	38		BLG3702
Total Credits Full Year Modules Semester 1 & 2			**46**		
TOTAL CREDITS FOR THE PROGRAMME			**134**		

***All co- and pre-requisites as indicated in the module descriptors in this programme are superseded by the admission requirements indicated under point 16.**

D.6.POST GRADUATE (MSC) PROGRAMME REGULATIONS: MASTER OF SCIENCE IN INDUSTRIAL BIOCHEMISTRY (11MSIB)

D.6.1. ADMISSION REQUIREMENTS

The MSc programme in Industrial Biochemistry is open to all BSc graduates with Biochemistry or other related majors . The admission to the MSc programme of the holders of the B.Sc. Biochemistry degree is not automatic. The applicants will be accepted on the basis of their undergraduate record. An average mark of **60%** is required. The course normally extends over a minimum period of two years for full-time students.

D.6.2. DURATION OF STUDY

The duration of the MSc in Biochemistry is two (2) years for full-time students and three (3) years for part-time students. Relevant committees may grant an extension of registration up to six (6) months beyond the stipulated period if valid reasons are advanced.

D.6.3. CURRICULUM COMPILATION

The curriculum for the MSc in Biochemistry consists of coursework and the writing of a research thesis. Refer to the Regulations for Postgraduate Courses of study in the General Prospectus: Information, Regulations & Fees.

D.6.4. ASSESSMENT CRITERIA

The curriculum for the MSc programme consists of coursework and research leading to a thesis. Coursework components in the first year will be assessed through written tests, laboratory work, seminar presentation and final examination. Each course assessment is based on a continuous assessment mark (50%) and examination mark (50%). Continuous assessment mark is computed as 60% test and 40% practical mark. In order to pass a course, a student must obtain a final mark of at least 50%. Refer to specific courses for detailed assessment criteria.

MSC THESIS IN THE SECOND YEAR:
A candidate must first successfully complete the coursework examinations before commencing thesis work. The thesis must be drafted in the English language and submitted to the supervisor. It must be in a university approved format. The thesis will be evaluated by UNAM approved internal and external examiners. The UNAM grading system will be used for the evaluation. Each student will defend the thesis in a viva voce examination. Refer to the General Information and Regulations Prospectus and Postgraduate Prospectus for detailed information.

D.6.5. REQUIREMENTS FOR QUALIFICATION AWARD

This qualification will be awarded to candidates credited with a minimum of 264 credits, and who have met all the requirements of the degree programme.

D.6.6. EXEMPTIONS

UNAM will give exemptions for equivalent courses taken at other tertiary institutions but the exemptions shall not exceed 50% of the programme in line with the General Information and Regulations Prospectus.

D.6.7. CLASS ATTENDANCE

In order to be admitted to examinations, students are required to attend at least 80% of the lectures and to complete the required elements that make up the continuous assessment mark. Hundred percent attendance of practical classes are required.

D.7. MASTER OF SCIENCE IN INDUSTRIAL BIOCHEMISTRY (11MSIB)

TABLE FOR ALL COURSES IN MASTER OF SCIENCE IN INDUSTRIAL BIOCHEMISTRY

YEAR 1

COURSE CODE	COURSE NAME	NQF Level	CREDIT	PRE-REQUISITE	CO-REQUISITE
UAE5819	Academic Writing for Post Graduate Students	9	24	None	None
CHM5911	Advanced Analytical and Instrumental Methods	9	24	None	None
CHM5921	Research Methodology and Project Proposal	9	12	None	None
CHB5921	Enzymology and Enzyme Technology	9	12	None	None
CHB5941	Nutrition, Metabolism and Cell Signaling	9	12	None	None
CHB5961	Neurobiochemistry and Clinical Biochemistry	9	12	None	None
CHM5962	Instrumental Methods and Techniques in Biochemical analysis	9	12	CHM5911	None
CHB5942	Biochemistry Seminars	9	12	CHM5921	None
CHB5962	Strategic Resource Management	9	12	CHM5921	None
CHB5902	Bioinformatics and Industrial Biotechnology	9	12	CHB5921	None
CHC5942	Environmental Toxicology and Management	9	12	CHB5941	None
CHN5942	Natural products and Pharmaceutical Production	9	12	CHB5961	None
Total Credits			**168**		

YEAR 2

Course code	Course name	NQF Level	Credit	Pre-requisite	CO-REQUISITE
CHB5900	M.Sc. Thesis	9	120	**Pass in all year 1 courses**	None
Total Credits			120		

FIRST YEAR

SEMESTER 1

CHM5911 Advanced Analytical and Instrumental Methods

Course Title: **Advanced Analytical and Instrumental Methods**
Code: **CHM5911**
NQF Level: 9
Contact Hours: 4 lectures per week for one semester and 36h Practical or mini project
Credits: **24**
Course Assessment: **CA** two tests which counts 80%; Laboratory work (or mini project) 20% towards.
Examination: There is a one 3hr examination **Final Mark: 50%** CA mark and **50%** Examination mark
Prerequisites: None

Course Description: (Selected topics of the following will be covered)**:** Electro-analytical chemistry: Ion selective electrodes, potentiometry, polarography, coulometry and electro-gravimetry. Advanced techniques in electro-analytical chemistry; solution electrode interface, Buttler-Volmer relationships, Chromatography - Theory of chromatography, High Performance Liquid Chromatography (HPLC), ion chromatography, supercritical fluid chromatography. Mass Spectrometry: (GC-MS) and Liquid Chromatography – Mass Spectrometry (LC-MS). Advanced mass spectrometry, basic instrumentation, ionization techniques, analyzers and detectors, vacuum technology, detailed ion fragmentation patterns and the practical application of electron impact, chemical ionization and other auxiliary mass spectrometry techniques, e.g. FABMS and electro spray MS, to the structure elucidation of both small and large organic molecules. X-ray analysis methods: Theory of X-ray Spectra. Conventional X-ray fluorescence analysis.Methods and instrumentation for excitation, dispersion detection and interpretation.Matrix effects and their avoidance.Energy dispersive X-ray analysis.Alternative X-ray analysers.Electron microprobe analyser.Single crystal X-ray analysis.Crystallography (theoretical principles, theory of crystals, X-rays, crystallographic techniques, structure determinations. NMR-Practical application of 1D and 2D Fourier transform NMR techniques. ^{1}H NMR and ^{13}C NMR.Non-first order spectra, basic experiments in DEPT, J-Mod. NOE diff. 2D homo-nuclear NMR- COSY, NOESY, TOCSY; hetero-nuclear direct (1J)- HECTOR, HMQC,HSQC; hetero-nuclear long range HMBC, LR HECTOR and COLOC.; selective 1D experiments: SEL TOCSY and SEL NOESY. Application of Analytical techniques to food science, pesticide analysis, forensic analysis, bio-analytical chemistry as well as other topics that are of interest.

CHB5921 ENZYMOLOGY AND ENZYME TECHNOLOGY

Course Title: **Enzymology and Enzyme Technology**
Course Code **CHB5921**
NQF Level 9
Contact Hours 2 lectures per week for one semester and 18h (cumulative) practical
NQF Credits 12
Continuon Assessment A minimum of two tests which counts 60%, Laboratory Mark (or mini project) counts 40%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Prerequisite None

Course Descriptor: Amino Acids and Peptides; Introduction to amino acids, peptides and proteins; Structures and properties of peptides; enzymes; Analysis of peptides and proteins; End group analysis of peptides; Solution phase peptide synthesis; Enzymes and Enzyme Inhibitors; Inhibition of hydrolases and peptidases, ACE inhibitors, Enzyme Technology - Large scale production of enzymes, enzyme reactors, immobilization of enzymes by chemical and physical methods, Effect of partition on kinetics and on changes in pH and hydrophobicity. Applications: synthetic organic chemistry, industry, food technology, medicines. Synzymes, enzyme electrodes and biosensors, Enzyme Engineering.

CHM5921 RESEARCH METHODOLOGY AND PROJECT PROPOSAL

Course Title: **Research Methodology and Project Proposal**
Course Code **CHM5921**
NQF Level 9
Contact Hours 2 lectures per week and 2h consultation per week for one semester
NQF Credits 12
Continuon Assessment Research proposal counts 80% and Statistics assessed by a test, assignment or report count 20%. **Final Mark: 100%** CA from which 20% is statistics component.
Prerequisite None

Course Descriptor: The lecturers will present some chemostatistics topics i.e. handling experimental data, processing and reporting, e.g. significance tests. Analysis of variance (ANOVA), regression analysis methods, validation experimental data (quality control) and experimental design and optimization of parameters. The student will write a comprehensive research proposal for his/her MSc research work in a particular field of national interest, under the supervision of an academic researcher. The evaluation will be done in accordance with UNAM Postgraduate School guidelines.

CHB5961 NEUROCHEMISTRY AND CLINICAL BIOCHEMISTRY

Course Title: **Neurobiochemistry and Clinical Biochemistry**
Course Code **CHB5961**
NQF Level 9
Contact Hours 2 lectures per week for one semester and 18h (cumulative) practical
NQF Credits 12
Continuon Assessment A minimum of two tests which counts 60%, Laboratory Mark (or mini project) counts 40%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Prerequisite None

Course Descriptor: Muscle Biochemistry – Skeletal muscle structure. Actin, myosin, tropomyosin, troponin.Molecular Mechanism of contraction. Functional classification of skeletal muscle fibers. Twitch. The motor unit.Role of calmodulin. Neuromorphology – Organisation of neuron, dendrites and axons. Glial cells – astrocytes, oligodendrocytes, ependymal cells, Schwan cells. Nerve fiber types and functions. Neurophysiology – Generation and conduction of monophasic action potential, saltatory conduction. Synaptic transmission, Neurotransmitters and their action.Blood Brain CSF barrier – Characteristics. Transport across membranes – Types of transport (simple diffusion, passive-facilitated diffusion), active transport – primary and secondary group translocation, transport ATPases, transport by vesicle formation. **Neurological disorders** – Headache, facial pain, migraine, epilepsy, multiple sclerosis, Myasthenia Gravis. Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption of electrolytes. **Diagnostic Enzymes** – Enzymes in health and diseases. Biochemical diagnosis of diseases by enzyme assays – SGOT, SGPT, CPK, cholinesterase, LDH. **Abnormalities in Nitrogen Metabolism** – Uremia, hyperuricemia, porphyria and factors affecting nitrogen balance. Blood Clotting – Disturbances in blood clotting mechanism – hemorrhagic disorders – hemophilia, von Willebrand's disease, purpura, Rendu-Osler-Werber disease, thrombotic thrombocytopenic purpura, disseminated intravascular coagulation, acquired prothrombin complex disorders, circulating anticoagulants. Cancer – Cellular differentiation, carcinogens and cancer therapy

CHM5991 Research Methodology and Project Proposal

Course Title: **Research Methodology and Project Proposal**
Code: **CHM5991**
NQF Level: **9**
Contact Hours: 2 lectures per week and 2h consultation per week for one semester
Credits: **12**
Course Assessment: Research proposal is graded and counts 80% toward the CA mark.Statistics component t is assessed by a test, assignment or report and count 20% towards the CA mark. Final Mark: **100%** CA from which 20% is statistics component.
Prerequisites: None

Course Description: The lecturers will present some chemostatistics topics i.e. handling experimental data, processing and reporting, e.g. significance tests. Analysis of variance (ANOVA), regression analysis methods, validation experimental data (quality control) and experimental design and optimization of parameters. The student will write a comprehensive research proposal for his/her MSc research work in a particular field of national interest, under the supervision of an academic researcher. The evaluation will be done at departmental level.

FIRST YEAR

SEMESTER 2

CHM5962 INSTRUMENTAL METHODS AND TECHNIQUES IN BIOCHEMICAL ANALYSIS

Course Title: **Instrumental Methods and Techniques in Biochemical analysis**
Course Code **CHM5962**
NQF Level 9
Contact Hours 2 lectures per week for one semester and 18h (cumulative) practical
NQF Credits 12
Continuon Assessment A minimum of two tests which counts 50%, Laboratory Mark (Mini project) counts 50%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Co-requisite CHM5911

Course Descriptor:Extraction of Organic Analytes: Sampling; Proximate Analysis of the Major Food Components; **Partition:** Gas/Liquid Partition (GLP), Liquid/Liquid Partition (LLP); Solid/Liquid Partition (SLP); **Solvation:**Solvent Extraction; Matrix Solid-phase Dispersion; Subcritical Fluid Extractions; Supercritical Fluid Extraction; Distillation Steam Distillation; Organic Solvent Distillation–Extraction; Adsorption. **Solid-phase Extraction:** application of HPLC, GC, FTIR, AA, AFS, MS and NMR to food analysis. **TRACE METAL DETERMINATIONS IN BIOLOGICAL SAMPLES:** Bioavailability; Methods for Assessing Folate and Vitamins Bioavailability; Physicochemical Analytical Techniques for Vitamins. **Recombinant DNA methods** –Construction and analysis of c-DNA and genomic libraries - Protocols and strategies for c-DNA cloning, preparation of radio-labeled DNA and RNA probes, synthetic oligonucleotide probes, expression of cloned genes in cultured cells, screening expression with antibodies and oligonucleotides, DNA sequencing. **Application of recombinant technology:** production of insulin, drugs, vaccines, diagnostic probe of genetic diseases, Gene therapy. **Cell Culture and Antibody Technology:** production, maintenance and applications of animal cell cultures and antibodies (both monoclonal and polyclonal), and the use of immunochemical techniques (e.g. ELISA, Western blotting and immunocytochemistry) for analysis and therapy, investigate the use of cellular systems for the study of mechanisms of toxicity and cell signalling pathways. Electrophoretic techniques, Electron microscopy.

CHB5962 STRATEGIC RESOURCE MANAGEMENT

Course Title:	**Strategic Resource Management**
Course Code	**CHB5962**
NQF Level	9
Contact Hours	2 lectures per week for one semester
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 80%, Laboratory Mark (or mini project) counts 20%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Co-requisite	CHM5921

Course Descriptor**:** Plant breeders' rights, the impact of genetically modified organisms and environmental monitoring, Biological safety conventions, environmental risk assessments and management ; Definitions and classifications of projects. Objectives in project management - time, costs, quality; Resources and resource management; Critical Path Methods and resource scheduling; Performance measurement and costs; Project lifecycles; Project teams and leadership in project management; Managing risk in projects; Analysis of project successes and failures; Case studies in project management; Project Management software. Examine innovation from an industrial perspective, showing how innovations of product, process and organisational structure can create and destroy markets. Focus on innovation from an organisational perspective, showing how innovation can create and sustain a powerful competitive advantage. Highlight the managerial perspective, illustrating the skills and systems required to maintain innovation within different organisations and markets. Consumer's attitudes and risk assessment: Risk assessment and avoidance: general principles; Assessing the impact of genetically modified crops;

CHB5902 BIOINFORMATICS AND INDUSTRIAL BIOTECHNOLOGY

Course Title:	**Bioinformatics and Industrial Biotechnology**
Course Code	**CHB5902**
NQF Level	9
Contact Hours	2 lectures per week for one semester and 18h (cumulative) practical
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 60%, Laboratory Mark (or mini project) counts 40%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Co-requisite	CHB5921

Course Descriptor**: Genomics, Transcriptomics, Proteomics:** Introduction to Programming using Java; Theory and Algorithms in Bioinformatics; Genomes to Systems; Biocomputing; structure-based drug design. Conventional and non-conventional techniques of plant hybridisation, Agrobacterium-induced transformation using wild-type and engineered strains of A. tumefaciens and A. rhizogenes; **Tissue culture,** micropropagation and protoplast fusion; DNA isolation for RAPD analysis and confirmation of hybridity; Evaluation of RAPD fragments patterns for **phylogeny analysis**; Analysis of transgenic plants and GMO testing. Direct DNA uptake into protoplasts; flow cytometric analysis for ploidy. **plant products f**or **non-food uses**, toxicology of natural pharmacologically active constituents and the use of transgenic plant technology for medical purposes. **molecular approaches to varietal profiling**, seed quality testing, transformation technology for modifying plant metabolism and modern breeding perspectives and strategies in a commercial context. comparisons of mutant with wild-type of model plant and crop species Arabidopsis and Maize lines, bioinformatics analysis of the genes involved in these phenotypes is undertaken. **Fermentation technology** – Fermentors, general design of fermentor, fermentation processes, production of alcohols, antibiotics, steroids and enzymes; biotransformation, biomass & production of single cell protein. **Hybridoma technology** – Monoclonal antibodies, selection of hybrids, hybridomas, purification and application of monoclonal antibodies. **Maj**or **Products of Industrial Microbiology:** Antibiotics, Penicillin, Streptomycin, Amino Acids, Organic Acids, Biopolymers, Biosurfactants; Bioconversion Processes.

CHB5942 BIOCHEMISTRY SEMINARS

Course Title:	**Biochemistry Seminars**
Course Code	**CHB5942**
NQF Level	9
Contact Hours	2 lectures per week for one semester
NQF Credits	12
Continuous Assessment	Presentations are graded by all the programme lecturers and count toward the CA mark. **Final Mark: 100%** CA mark
Co-requisite	CHM5921

Course Descriptor**:** The main component of this course involves the application of presentation skills through seminars, review of scientific literature and communication of recent developments in biochemistry.

CHN5942 NATURAL PRODUCTS AND PHARMACEUTICAL PRODUCTION

Course Title:	**Natural products and Pharmaceutical Production**
Course Code	**CHN5942**
NQF Level	9
Contact Hours	2 lectures per week for one semester and 18h (cumulative) practical
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 60%, Laboratory Mark (or Mini project) counts 40%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Co-requisite	CHB5961

Course Descriptor**: GenePharming** (Animals and Plants) Vitamins, Amino Acids, Proteins Antibiotics, Biocatalysis. **Natural Compounds** Recovery/(Bio-Processing, Chemical–Biotechnological Syntheses, Gene Therapy. **Vect**or**s/Systems Production:** Safety, Efficacy, Consistency, and Specificity Registration. Terpenes, occurrence, nomenclature and classification; Biosynthesis and structure of the steroids; Fatty acids and cell wall structures; The prostaglandins; The alkaloids. Cell wall structure and peptidoglycan targets b-Lactam antibiotics: action and b-lactamase chemistry, Sulfonamides, **Metabolic targets:** pyridoxal dependent groups, Gastric acid secretion as a target for chemotherapy, Chemical regulation of acid secretion.

CHC5942 ENVIRONMENTAL TOXICOLOGY AND MANAGEMENT

Course Title:	**Environmental Toxicology and Management**
Course Code	**CHC5942**
NQF Level	9
Contact Hours	2 lectures per week for one semester and 18h (cumulative) practical
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 60%, Laboratory Mark (or mini project) counts 40%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Co-requisite	CHB5941

Course Descriptor**:** Microbial Growth in Complex Environments: Biodegradation Using Natural Microbial Communities; Changing Environmental Conditions to Stimulate Biodegradation; **Subsurface Engineered Bi**or**emediation** System; Stimulating Hydrocarbon Degradation in Waters and Soils; Phytoremediation; Stimulation of Metal Bioleaching from Minerals; **Biosens**or**s:** Detection of pollution, and microbial contamination of water. Fermentation analysis and control Monitoring of industrial gases and liquids Measurement of toxic gas in mining industries Direct biological measurement of flavors, essences, and pheromones; **Biopesticides; Xenobiotic metabolism** – Biodegradation, detoxification of xenobiotics by microorganisms , biodegradation of hydrocarbons, pesticides, surfactants, polyaromatic hydrocarbons, dyes; role of cytochrome P450 in detoxification.

CHB5900/ CHM5900/ MRE 5900 MSC THESIS

Course Title:	**MSc Thesis**
Course	**CHB5900/ CHM5900/ MRE590**
NQF Level	9
Contact Hours	Face to face consultations with supervisor(s) on regular bases
NQF Credits	120
Continuon Assessment	**Final Mark: 100%** CA mark
Prerequisite	Pass in all year 1 courses is required before a student can start with the research project.

Course Assessment: A candidate must first successfully complete the coursework examinations before commencing thesis work. The thesis must be drafted in English language and submitted to the supervisor. It must be in a format given by the coordinators. The thesis will be evaluated by the supervisor and another examiner within one month after submission. The UNAM grading system will be used for the evaluation. Each student will defend the thesis in a viva voce examination. Refer to the General Information and Regulations Prospectus for detailed information.

Course Descriptor**:** Students will present their findings in the form of a written thesis. Poster and seminar presentations are encouraged. This course tests a student's ability to design and implement a research programme, and communicate the findings to an informed audience in a comprehensive thesis, written in an appropriate scientific style. The timing of assessments and assessment deadlines have been planned to ensure that the volume of work is balanced throughout the programme. These do not only enable students to acquire in-depth practical training under the supervision of experienced research staff but they also help to develop their capacity for independent investigation and report writing. Most projects are laboratory-based although some data review, computer-based projects may be available. Research projects are carried out for a minimum period of 1 year for full time students or 2 years for part time students.

D.8. MASTER OF SCIENCE IN BIODIVERSITY MANAGEMENT (11MSCE)

D.8.1. DEPARTMENTAL REGULATIONS

D.6.1.1. ADMISSION REQUIREMENTS

The MSc Biodiversity Management program in the Department of Biological Sciences is open to applicants with at least a Bachelor's degree at NQF level 8 or equivalent with Biology or related majors. The applicants will be accepted on the basis of their undergraduate records with an average mark of at least 60%.

D.8.1.2. DURATION OF STUDY

The Master of Biodiversity Management is offered through coursework and thesis, extending over two years of full-time study. The coursework is conducted during the first academic year of study and is followed by a supervised original research project extending over the second year.

D.8.1.3. CURRICULUM COMPILATION

The curriculum for the Biodiversity Management consists of coursework and the writing of a research thesis. Refer to the Regulations for Postgraduate Courses of study in the General Prospectus: Information, Regulations & Fees.

D.8.1.4. EXAMINATION REGULATIONS

Formal examination will take place at the end of each semester. Examinations will be subject to external assessment. In addition to module-specific regulations, attendance of at least 80% in a particular module is a requirement for examination admission. Students must pass all modules for them to proceed to the master thesis. A mixture of assessment modes will be used: written, oral or practical examinations, reports and presentations.

D.8.1.5. FORMAT AND EVALUATION OF THESIS WORK

Before a candidate can proceed to the thesis, he/she must first successfully complete the coursework examinations. Each student will submit a Master Thesis/Dissertation during the second year. The thesis must be drafted in English language. The thesis must follow the format given by the School of Postgraduate Studies as outlined in the Prospectus for Postgraduate Studies. The thesis will be evaluated bytwo examiners within two months after submission. The UNAM grading system will be used for the evaluation.

D.8.1.6. PRACTICALS

Attendance of practical classes and field trips are compulsory.

QUALIFICATION: MASTER OF SCIENCE BIODIVERSITY MANAGEMENT (11MSCE)

D.8.2. COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

YEAR 1

CODE	MODULE	SEMESTER	CREDIT	COMPULSORY/ ELECTIVE	PRE-REQUISITE
EBM5921	Biostatistics, Scientific Presentation & Publication	1	12	Compulsory	None
UAE5819	Academic Writing for Post Graduate Students	1	NCB	Compulsory	None
EBM5931	Assessing Biodiversity	1	24	Compulsory	None
EBL5931	Integrated Water and Land use and Biodiversity Management	1	24	Compulsory	None
EBL5962 **OR** EBL5942	Natural Resource Economics **OR** Environmental Law	2 2	12 12	Elective Elective	None None
EBL5952 **OR** EBM5922 **OR** EBB5922	GIS and Remote sensing **OR** Management of Natural History Collections **AND** Applied Biogeography	2 **OR** 2 **OR** 2	24 12 12	Elective Elective Elective	None None None
EBB5972 **OR** EBB5952	Functional Biodiversity of Terrestrial Ecosystems **OR** Functional Biodiversity of Aquatic Ecosystems	2 **OR** 2	24 24	Elective Elective	None None
Total Number of Credits for Year 1			**120**		

YEAR 2

CODE	MODULE NAME	SEMESTER	CREDIT	COMPULSORY/ELECTIVE	PRE-REQUISITE
EBL5900	Thesis	1 & 2	120	Compulsory	Pass all first Year modules unless stipulated otherwise in the general regulations
Total Number of Credits for Year 2			**120**		
Total Number of Credits for the Programme			**240**		

FIRST YEAR MODULES

UAE5819 ACADEMIC WRITING FOR POST GRADUATE STUDENTS

Module Title:	**ACADEMIC WRITING FOR POST GRADUATE STUDENTS**
Code:	**UAE5819**
NQF Level:	9
Contact hours:	42
Credits:	NCB
Module Assessment:	CA: Students will submit written assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment **40%**, Examination **60%** (1 x 3 hour paper)
Prerequisites:	Must be a registered postgraduate student

Content: This module is a post-graduate course designed to empower students with skills and knowledge to access and critique academic sources and to synthesize information from these sources to assist them in the substantiation and development of their own claims when writing an academic paper in their respective fields of specialization. Additionally, this course will empower students with the capacity to undertake the challenges of academic writing by exposing them to the different rhetorical and stylistic elements typical of academic texts. Finally, students will be introduced to the American Psychological Association (APA) writing style and will be equipped with the necessary skills to format an academic paper in APA style.

EBM5931 ASSESSING BIODIVERSITY

Module Title:	**ASSESSING BIODIVERSITY**
Code:	**EBM5931**
NQF Level:	9
Contact hours:	56 hours lectures and 42 hours practicals. Some of the practicals are conducted during field trips.
Credits:	24
Module Assessment:	Students will be assessed through a wide range of assessments methods which will include but not be limited to seminar presentations, written practical assignments or field trip reports, at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 40%, Examination 60% (1 x 3 hour paper)
Prerequisites:	None

Content: A general overview about the history of biodiversity research; important definitions for biodiversity research; introduction to the significance and vulnerability of biodiversity; rational for biodiversity assessment, levels at which biodiversity may be assessed; genetic, species, ecosystem, biome and global scale; latitudinal diversity gradients, global versus regional diversity, ecological processes and habitat heterogeneity, biodiversity indices, introduction into various methodological approaches for assessment of biodiversity (biodiversity assessment methods; Gap analysis, conservation biodiversity workshops, National Conservation review, All Taxa Biodiversity Inventory [ATBI], Rapid Biodiversity Assessment, Rapid Assessment Programme, rapid biodiversity appraisal versus long-term ecological monitoring, line transects versus plot design, spatial and temporal organisation of organisms, species, populations); the concept of bioindicators; functional zoodiversity; scaling, tracking and monitoring procedures; the role of habitat (diversity, abundance and habitat use); ecological niches and inter-specific occurrence (contractors versus empires); radio-telemetry; delineation of research; selected examples of data collection and description; spatial orientation and time (seasonality); behavioural studies for biodiversity research; formulation of hypotheses; testing of hypothesis; designing and need for adaptation of monitoring programs, communities, ecosystems and biomes; humans and the biosphere (human population dynamics, shrinking of resources); scientific nature conservation; IUCN Red List; bioprospecting; buffer zones and migration corridors; working with landowners and local communities; making results available for conservation authorities.

EBM5921 BIOSTATISTICS, SCIENTIFIC PRESENTATION AND PUBLICATION

Module Title:	**BIOSTATISTICS, SCIENTIFIC PRESENTATION AND PUBLICATION**
Code:	**EBM5921**
NQF Level:	9
Contact hours:	28 hours lectures and 42 hours practicals
Credits:	12
Module Assessment:	Students will be assessed through a wide range of assessments methods which will include but not be limited to seminar presentations, practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 40%, Examination 60% (1 x 3 hour paper). Weighting: Continuous assessment **40%,** Examination **60%** (1 x 3 hour paper)
Prerequisites:	None

Content: Revision of Descriptive Statistics (measures of location and spread as well as graphical presentation of data). Statistical Inference: Parametric as well as Nonparametric methods. Agricultural Experimentation: Principles of experimental design for on-station and adaptive field research trails, Repeated measurements; Analysis of data from balanced designs. Some basic designs: Latin squares, Randomized Complete Block Designs, Completely randomised designs, Split-plot designs – applications to field experiments and trails. Methods of analysing multiple experiments, data management. Multivariate analysis: Introduction to the nature of multivariate data; techniques available for exploring and analysing multivariate data sets; multiple regression analysis; multivariate analysis of variance (MANOVA); Ecological classification - Definition and aims of ecological classification; Introduction to Cluster Analysis; types and uses of different Cluster Analysis techniques (Divisive, Agglomerative, Hierarchical, Non-hierarchical), Selected practical examples in the use of Clustering methods available cluster statistics (e.g. average linkage, single linkage, etc.) using various computer software (e.g. TWINSPAN, SPSS, MINITAB, PRIMER) and interpretation of cluster dendrograms; Gradient analysis - Introduction to gradient analysis and ordination techniques, types and assumptions of ordination techniques, indirect gradient analysis (indirect ordination) concept and purpose (e.g. Principal Components Analysis, Detrended Correspondence Analysis, etc.), direct gradient analysis (direct/canonical ordination, e.g. Canonical Correspondence Analysis; etc.), Selected practical examples in the use of gradient analysis methods using various computer software (e.g. CANOCO, PRIMER, DECORANA, etc.) and interpretation of ordination plots. Definition of and reasons for communication and presentation. Modes of communication and presentation. Is there difference between communication and presentation? Why scientific communication and presentation? The Scientific method, communication and presentation. What is research? Ethics of scientific research, Overview of the scientific method.Graphical presentation of research data, Distinction between data analysis and presentation; Graphs, pie charts, tables, figures, photographs, cartoons etc. Oral scientific presentation; Oral presentation, Use of power point. Written scientific communication: Generic components of scientific writing;Title, abstract, introduction, literature review, aims and objectives, hypotheses (null, alternative, research), key questions, materials and methods, results (graphical presentation of research data, citing statistical test outcomes, description of trends of research data), discussion of research results, drawing conclusions based on research results, summary of results, recommendations, references, appendices / annexes; Practical (research) report; Review articles (literature review), Writing the thesis. Preparation of a scientific poster. Posting Information on the Web.

EBB5922 APPLIED BIOGEOGRAPHY

Module Title:	**APPLIED BIOGEOGRAPHY**
Code:	**EBB5922**
NQF Level:	9
Contact hours:	28 hours lectures and 21 hours practicals
Credits:	12
Module Assessment:	Students will be assessed through a wide range of assessments methods which will include seminar presentations, poster presentations, written practical assignments or reports and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 40%, Examination 60% (1 x 2 hour paper)
Prerequisites:	None

Content: Patterns of distribution of plants, animals and communities: distribution on different scales from local to global, distribution maps, general explanation of distribution patterns: environmental factors, species interactions, geographical barriers, plate tectonics and the distribution of organisms, endemism, disjunctions and cosmopolitanism. From species to ecosystems, relations of ecosystems to climate and soils, climate zones and ecoregions: global and African perspectives, environmental gradients, ecotones and ecoclines, forest lines. Biodiversity: aggregation of observations and explanation. Global, regional and local patterns of diversity and explanatory theories. Dynamics: special problems. Species: evolution and extinction, seasonal variations, migration with examples from Namibia. Communities: dispersal, alien invasions and extinctions, disturbance regimes, habitat fragmentation and global change. Humans and the biosphere: special problems. Human geography and biogeography, human habitat alteration, human use of biodiversity. Conservation: red lists, island biogeography and design of nature reserves, ecological landscape design. Bioindication: assessment of the state of natural resources. Environmental impact assessment, environmental monitoring; deforestation, desertification. Climate change: causes and evidence of climate change, climate change adaptation and mitigation, effects of climate change on distribution of organisms and various levels of biological diversity, challenges of climate change in Namibia, Africa and elsewhere.

EBL5931 Integrated Water and Land use and Biodiversity Management

Module Title:	Integrated Water and Land use and Biodiversity Management
Code:	**EBL5931**
NQF Level:	9
Contact hours:	56 hours lectures
Credits:	24
Module Assessment:	Students will be assessed through a wide range of assessments methods which will include but not be limited to seminar presentations, written practical assignments or reports, during the semester that will form part of continuous assessment. Weighting: Continuous assessment 40%, Examination 60% (1 x 3 hour paper)
Prerequisites:	None

Content: Biodiversity and Agriculture; Eco zones and agriculture, Agriculture and biodiversity: reasons and example for negative and positive impacts on biodiversity. Sustainable land use systems, like Organic Farming, Low-Input-Sustainable Agriculture, Agro-forest systems, Management of biodiversity in agricultural production systems, like crop rotation and integrated pest management. Holistic land use planning – example planning of a biodiversity based agricultural eco system. Resource management; Definitions: Resource management; Resource development; biodiversity; sustainable development; Pre-cautionary approach; Objectives of resource management, Global development and the environment. History of conservation in Namibia and present conservation approaches – The Namibian National Biodiversity Programme and Strategy and Action plan. Key elements on which a manager needs information to achieve sustainable exploitation of resources. Social and economic dimensions in resource management. Conflicts that exist between different user groups. Management of wildlife, enhancing productivity without resource degradation. The ecosystem approach for resource management. Adaptive management.Definitions, History and Evolution of Integrated water resources management (IWRM). Sectoral approach versus Cooperative approach and Integrated approach. The integrated approach and key principles of integrated water resource management. IWRM plan for Namibia and case studies and integrated coastal zone management.

EBL5962 NATURAL RESOURCE ECONOMICS

Module Title:	**NATURAL RESOURCE ECONOMICS**
Code:	**EBL5962**
NQF Level:	9
Contact hours:	28 hours lectures
Credits:	12
Module Assessment:	Students will be assessed through a wide range of assessments methods which will include but not be limited to seminar presentations, written practical assignments or reports, at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 40%, Examination 60% (1 x 2 hour paper)

Content: Spatial development and management on the local and regional level. Factors and principles of population and economic growth: population development (natural, migration), population pyramid, Malthusian hypothesis, environmental constraints, demographic transition. Economic change in the development process: sectors of the economy, three sector hypothesis, reasons for sectoral change, sector-specific differences between industrial and developing countries. Land use forms: Thünen's land use theory, bid-price curves, modifications to the theory, role of transportation costs. Economic activities in space and their spatial patterns: locational decision-making, footloose industries, central place theory, ranges of goods, locational patterns of services. Locational systems in time: Vance's model, rank size rule, neoclassical models, polarisation models, polarisation-reversal hypothesis, long wave theory, product life cycle theory. Regional multiplier effects: forward, backward and service linkages, external and internal agglomeration effects, spread and backwash effects, agglomeration advantages and disadvantages. Instruments and strategies of regional economic development: targets, basic decisions, instruments, spatial strategies. Spatial development and management on the global level. Global disparities: GDP/GNP, per capita income, economic and social indicators, Human Development Index, ecological indicators. Spatial effects of globalization: globalisation and regionalisation, supranational integration spaces, import substitution and export diversification, institutional framework of globalisation, trade (reasons, global patterns), comparative cost advantages, term of trade, foreign direct investments (positive and negative effects, global patterns). Commodity chains: producer-driven commodity chains, consumer-driven commodity chains, governance and spatial consequences. Agricultural Value Chains and the proliferation of global standards. Rural Development in the context of globalisation with a special focus on African small scale farmers. Globalisation and the environment: global diversity, environmental hazards, fresh water, pollution shares, economics of biodiversity.

EBL5942 ENVIRONMENTAL LAW

Module Title:	**ENVIRONMENTAL LAW**
Code:	**EBL5942**
NQF Level:	9
Contact hours:	28 hours lectures
Credits:	12
Module Assessment:	Students will be assessed through a wide range of assessments methods which will include but not be limited to seminar presentations, written assignments that will form part of continuous assessment. Weighting: Continuous assessment 40%, Examination 60% (1 x 2 hour paper)

Content: Concept and Scope of the Environment and its law, Foundations and Functions of International Environmental Law, Sources of international and national Environmental Law,
International institutions, Principles of International Environmental Law, Compliance and dispute settlement, Criminal aspects of Environmental Law, Sectoral and trans-sectoral regulation (national, regional and international)

EBL5952 GIS AND REMOTE SENSING

Module Title:	**GIS AND REMOTE SENSING**
Code:	**EBL5952**
NQF Level:	9
Contact hours:	56 hours lectures and 42 hours practicals
Credits:	24
Module Assessment:	Students will be assessed through a wide range of assessments methods which will include but not be limited to seminar presentations, written practical assignments or reports, at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 40%, Examination 60% (1 x 3 hour paper)

Content: Application and benefits of GIS, Elements of GIS, Basic Geographic Concepts, Cartographic concept of the real world, Scale of Measurement, Spatial location and reference, Projections and coordinate systems. **GIS Data Models**, Relational database management system, Graphic representation of entities, Vector GIS, Raster GIS. **Data Input, Storage and Editing**, Primary and Secondary data input devices, GPS, Digitizing, Scanning, Data conversions, Remote Sensing data. **Data Analysis, Data Query**, Classification, Buffers, Neighborhood functions, Comparison of variables among maps. **Data Output and Presentation,** The designing process, Map design controls, Non-cartographic output. What is meant by remote sensing? Electromagnetic radiation; Platforms and sensors – Remote Sensed data sources, Image processing and analysis, Thematic applications. Display and manipulation of image files; image pre-processing: radiometric and spectral enhancement; geometric corrections; remote sensing for land use/land cover identification; remote sensing for vegetation monitoring. Remote Sensing for hydrosphere. Map composition and GIS integration (raster/vector)

EBM5922 MANAGEMENT OF NATURAL HISTORY COLLECTIONS

Module Title:	**MANAGEMENT OF NATURAL HISTORY COLLECTIONS**
Code:	**EBM5922**
NQF Level:	9
Contact hours:	28 hours lectures and 21 hours practicals
Credits:	12
Module Assessment:	Students will be assessed through a wide range of assessments methods which will include but not be limited to seminar presentations, written practical assignments or reports, at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 40%, Examination 60% (1 x 2 hour paper)

Content: Purpose of collections (introduction, definition of collections, ethics, operational planning); specimen acquisition (field preservation, preservation fluids and fixatives, specimen labelling, microscope preparation, vertebrate preparation, botanical preparation, skeletal reconstruction, gene and tissue banks); collection management (infrastructure management, record keeping, specimen management, information extraction, information management, digital information capture, electronic information processing, collection development planning); information dissemination (exhibitions and education, practical display techniques, practical education techniques); specimen identification (character sets, paper based identification media, morphometric identification media, electronic identification media, building character sets for identification keys, constructing keys) . Overview of herbaria and museums, their functions and importance: Definition, objectives and importance of herbaria and museums; use of collections in research, exhibits and educational programs, and how collections can be used to help educators meet science education goals; Types of herbaria: National, Private, University and combinations of these; Types of collections: Type specimens, Main collection, Carpological collection, Bulky specimens, Xylarium, Bryophytes & Lichens, Macrofungi, Fossils, Spirit collection, Illustrations, Photographs & Copies of specimens, Microscope slides. Herbarium and museum curation: Collection management procedures and preservation techniques including acquisitions and accessions, specimen preparation, exchanges, loans, access and use, documentation, storage, conservation, pest control, profiling, cataloging, digitization, and administration. Database use and management: Types of databases used, practices and procedures of information capture, entry and retrieval; importance of back-ups; uses of the data on the system. Challenges faced by herbaria and museums, and opportunities to be explored to enhance their functions.

EBB5972 FUNCTIONAL BIODIVERSITY OF TERRESTRIAL ECOSYSTEMS

Module Title:	**FUNCTIONAL BIODIVERSITY OF TERRESTRIAL ECOSYSTEMS**
Code:	**EBB5972**
NQF Level:	9
Contact hours:	56 hours lectures and 42 hours practicals. Some of the practicals will be conducted during field trips
Credits:	24
Module Assessment:	Students will be assessed through a wide range of assessments methods which will include but not be limited to seminar presentations, written practical assignments or field trip reports, at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 40%, Examination 60% (1 x 3 hour paper)

Content: Ecology and management of tropical savanna ecosystems: Introduction to savanna ecosystems of southern Africa and elsewhere (Definition, extent and distribution, major types of savannas, etc.); Overall species diversity, richness and endemism; Characteristics of savanna ecosystems of southern Africa (structure, tree-grass interactions, etc.; Determinants of tropical savannas (primary, secondary); management of savannas for biodiversity conservation; Modeling savanna dynamics for biodiversity conservation and restoration.

Ecology and management of forest ecosystems: Overview of forest ecosystems of the world (definition, types of forests; distribution and extent, etc.); characteristics and biodiversity and of tropical forests; Overall species diversity, richness and endemism in tropical forest ecosystems; Causes of biodiversity loss in forests (fragmentation and deforestation, logging; hunting, invasives, etc.); Impacts of climate change on forest diversity (potential and actual impacts); Forest gap and edge dynamics.

Ecology and management of desert ecosystems: Introduction to the distribution, origin, types and characteristics of desert ecosystems of Namibia and elsewhere; Overall species diversity, richness and endemism in desert ecosystems; Ecophysiology in conditions of water limitation, food limitation, and heat: sources, limitations, time-space windows. Desert Ecology: life history patterns, community and population processes, food-webs, autecology, Biodiversity in deserts: source-sink effects, patchiness, speciation processes and local extinction/persistenceAdaptations of plants to the desert environment (physiological, anatomical, physical, etc.); Adaptations of animals to the desert environment (physiological, anatomical, physical, behavioural, etc.); Desertification: causes, occurrence, criteria for indicators, possibilities of combating, Impacts of humans on desert biodiversity (mining, off-road driving, harvesting, etc.), Ecological Restoration in a desert environment (biological engineering of ecosystem function, integration of ecological knowledge, designing restoration research, managing restoration in practice, monitoring of indicators, ecological restoration for sustainable development).

Biodiversity and Ecosystem function in terrestrial Ecosystems: Consequences of changing biodiversity on ecosystem functioning; Models on Biodiversity and Ecosystem function.

EBB5952 FUNCTIONAL BIODIVERSITY OF AQUATIC ECOSYSTEMS

Module Title:	**FUNCTIONAL BIODIVERSITY OF AQUATIC ECOSYSTEMS**
Code:	**EBB5952**
NQF Level:	9
Contact hours:	56 hours lectures and 42 hours practicals. Some of the practicals can be conducted during field trips
Credits:	24

Module Assessment: Students will be assessed through a wide range of assessments methods which will include but not be limited to seminar presentations, written practical assignments or field trip reports, at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 40%, Examination 60% (1 x 3 hour paper)

Content: Life in fluid medium, Physical and chemical properties of freshwater and marine ecosystems (Light, Temperature, Pressure, Salinity, Nutrients, Dissolved gases, Circulation – currents; deep circulation; upwelling)**. The Pelagic environment** – conditions (structure), niches (distribution of species in multi-dimensionsional niche space), plankton both frehswater and marine (patchy distribution of plankton, density dynamics of plankton and the role of upwelling, biological production and its assessment, Harmful algal blooms, zooplankton, density dynamics, Diel vertical migrations); Nekton; organisms and processes in the open ocean; pelagic food webs. **The Benthic environment:** Organisms inhabiting soft substrates and hard substrates, The intertidal zone environment (sandy and rocky shores, exposed and sheletered shores), The rocky intertidal zone as a model system for community ecology research **(lecture/excursion),** Benthic communities in Estuaries as dynamic environments, mangroves, marshes, coral reefs Deep sea bed (focus on feeding and reproductive ecology). The profundal zone in freshwater systems**. Top predators** and their ecological role in aquatic food webs, effects of loosing top predators in aquatic ecosystems. **Microbial loop in aquatic systems**

EBL5900 THESIS

Module Title:	**THESIS**
Code:	**EBL5900**
NQF Level:	9
Contact hours:	280
Credits:	120
Module Assessment: 100%	The written thesis is assessed and make up 100% of the final mark.
Prerequisites:	Student must pass all year 1 modules
Content:	The content and nature of research for the thesis will depend on the topic of research selected by the student.

D.9. MASTER OF SCIENCE IN MICROBIOLOGY (11MMBL)

D.9.1. DEPARTMENTAL REGULATIONS

D.9.1. ADMISSION REQUIREMENTS

Applicants who have obtained a Bachelor's of Science (Hons) degree in Microbiology, Biochemistry, Molecular Biology, Biotechnology, Food Science, and Veterinary Sciences at NQF level 8 are eligible to apply. The applicants will be accepted on the basis of their undergraduate records with an average mark of at least 60%. Applicants who graduated from UNAM with a 4-year BSc degree and an average of at least 60% may also be admitted if they passed Research Methodology and had a Research component in Microbiology or Molecular Biology as part of their undergraduate degree. The department will evaluate such applications. Admission is competitive and a maximum of 20 students will initially be allowed into the programme.

D.9.1.2. DURATION OF STUDY

The Master of Microbiology is offered through coursework and thesis, extending over two years of full-time study. The coursework is conducted during the first academic year of study and is followed by a supervised original research project extending over the second year.

D.9.1.3. CURRICULUM COMPILATION

The curriculum for the MSc Microbiology consists of coursework and the writing of a research thesis. Refer to the Regulations for Postgraduate Courses of study in the General Prospectus: Information, Regulations& Fees.

D.9.1.4. EXAMINATION REGULATIONS

Formal examination will take place at the end of each semester. Examinations will be subject to external assessment. In addition to course-specific regulations, attendance of at least 80% in a particular course is a requirement for examination admission. Students must pass all courses for them to proceed to the master thesis. A mixture of assessment modes will be used: written, oral or practical examinations, reports and presentations.

D.9.1.5. FORMAT AND EVALUATION OF THESIS WORK

Before a candidate can proceed to the thesis, he/she must first successfully complete the coursework examinations. Each student will submit a Master Thesis/Dissertation during the second year. The thesis must be drafted in English language. The thesis must follow the format as prescribed in the guide for Post-graduate studies at UNAM. The thesis will be evaluated by internal and external examiner within one month after submission. The UNAM grading system will be used for the evaluation.

D.9.1.6. PRACTICALS

Attendance of practical classes and field trips is compulsory.

D.10. COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

QUALIFICATION: Master of Science Microbiology (11MMBL)

YEAR 1

CODE	COURSE	NQF LEVEL	PRE-REQUISITE	CREDIT	COMPULSORY / ELECTIVE	CORE-REQUISITE
All students in this programme will take all of the following courses						
MMB5921	Computing Techniques and Bioinformatics	**9**	Admission requirements	12	Compulsory	none
UAE5819	Academic Writing for Post Graduate Students	**9**	Must be a registered postgraduate student	NCB	Compulsory	none
MMB5922	Microbial Evolution	**9**	Admission requirements	12	Compulsory	none
MMB5941	Research Methodology and Project Proposal Writing	**9**	Admission requirements	12	Compulsory	none
MMB5942	Bio prospecting and Entrepreneurship in Microbiology	**9**	Admission requirements	12	Compulsory	none
Students in the Food Microbiology stream will take all of the following courses						
MMF5911	Food Microbiology	**9**	Admission requirements	24	Compulsory	none
MMF5921	Food safety	**9**	Admission requirements	12	Compulsory	none
MMF5912	Food Biotechnology	**9**	Admission requirements	24	Compulsory	none
MMF5922	Climate Change and Food Security	**9**	Admission requirements	12	Compulsory	none
MME5912	Microbiology of wastewater	**9**	Admission requirements	24	Compulsory	none
Students in the Biomedical Microbiology stream will take all of the following courses						
MMM5931	Clinical Microbiology and Diagnostics	**9**	Admission requirements	24	Compulsory	none
MMM5911	Microbial Principles and Processes	**9**	Admission requirements	24	Compulsory	none
MMM5912	Molecular Microbiology and Biotechnology	**9**	Admission requirements	24	Compulsory	none
MMM5932	Climate Change and emerging diseases	**9**	Admission requirements	24	Compulsory	none
Students in the Environmental Microbiology stream will take all of the following courses						
MME5911	Environmental Biotechnology	**9**	Admission requirements	24	Compulsory	none
MME5921	Geo-Microbiology and biogeochemistry	**9**	Admission requirements	12	Compulsory	none
MME5912	Microbiology of wastewater	**9**	Admission requirements	24	Compulsory	none
MME5922	Extremophiles	**9**	Admission requirements	12	Compulsory	none
MME5932	Climate change and Microbial Biodiversity	**9**	Admission requirements	24	Compulsory	none
Total Credits				**144**		

YEAR 2

SEMESTER	COURSE NAME	NQF LEVEL	PRE-REQUISITES	CREDIT	COMPULSORY/ ELECTIVE	CORE-REQUISITE
MMB5900	Thesis	**9**	Student must pass all year 1 courses	120	Compulsory	none
Total Credits				**120**		

FIRST YEAR COURSES

UAE5819 ACADEMIC WRITING FOR POST GRADUATE STUDENTS

Course Title: **ACADEMIC WRITING FOR POST GRADUATE STUDENTS**
Code: **UAE5819**
NQF Level: 9
Contact hours: 42
Credits: NCB
Course Assessment: CA: Students will submit written assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment **40%**, Examination **60%** (1 x 3-hour paper)
Prerequisites: Must be a registered postgraduate student
Content: This course is a post-graduate course designed to empower students with skills and knowledge to access and critique academic sources and to synthesize information from these sources to assist them in the substantiation and development of their own claims when writing an academic paper in their respective fields of specialization. Additionally, this course will empower students with the capacity to undertake the challenges of academic writing by exposing them to the different rhetorical and stylistic elements typical of academic texts. Finally, students will be introduced to the American Psychological Association (APA) writing style and will be equipped with the necessary skills to format an academic paper in APA style.

MMB5941Research Methodology and Project Proposal writing

Course Title: **Research Methodology and Project Proposal writing**
Code: **MMB5941**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Students will submit written assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3-hour paper)
Prerequisites: Must be a registered postgraduate student
Content: In this course the following content will be covered: Research design; project planning, Proposal writing; problem analysis; Research questions formulation; quantitative and qualitative Bio statistical methods of data analysis in Microbiology, research ethics and responsibilities.

MMB5921Computing Techniques and Bioinformatics

Course Title: **Computing Techniques and Bioinformatics**
Code: **MMB5921**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Students will submit independent practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3-hour paper)
Prerequisites: Must be a registered postgraduate student
Content: Genome sequence acquisition and analysis, genomes sequence answers to specific questions, genome variations, DNA microarrays, proteomics, Protein 3D structures, Whole genome perspectives, genomic circuits in single genes, integrating single gene circuits, complex gene circuits, modeling whole genome circuits, genomics and medical case studies

MMB5922Microbial Evolution

Course Title: **Microbial Evolution**
Code: **MMB5922**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3-hour paper)
Prerequisites: Must be a registered postgraduate student
Content: The content for this course will include: formation and early history of earth; origin of cellular life, microbial diversification; endosymbiotic origin of eukaryotes, the evolutionary process, theoretical aspects of evolutionary analysis; analytical methods of evolutionary analysis, microbial phylogeny, various phylogenetic methods, microbial classification and nomenclature

MMB5942Bio prospecting and Entrepreneurship in Microbiology

Course Title: **Bio prospecting and Entrepreneurship in Microbiology**
Code: **MMB5942**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3-hour paper)
Prerequisites: Must be a registered postgraduate student
Content: The content of this course will deal with: Definitions and theory-practice of bioprospecting; a critique of bioprospecting; bioprospecting as post-modern ecological capitalism; Bioprospecting for genetic resources; Bioprospecting for Microbes; Bioprospecting of medicinal plants and drug natural products , Bioprospecting for natural food products and nutriceuticals; Bioprospecting for new species of microbes, plants, and animals; Bioprospecting of desert, soil, marine and other environments; Policies, laws, regulations, and conventions that guide bioprospecting; Case studies of bioprospecting programmes; Valuation of bioprospecting samples. In addition, this course focuses on the realities of working in the field of microbiology and biotechnology. It includes aspects such as entrepreneurship development, economic implications and financing, intellectual property and patents, bioethics, biotechnology and public understanding thereof. Knowledge and insights gained from this course will be assessed by means of a simulated grant application for the development of a hypothetical microbiological/biotechnological venture.

MMF5912Food Biotechnology

Course Title: **Food Biotechnology**
Code: **MMF5912**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Continuous assessment will be composed of the graded reports during laboratory presentation as well as 2 assignments that will be presented orally and 1 written assignment. Continuous assessment 50%, Examination 50% (1 x 3 hour paper).
Prerequisites: Must be a registered postgraduate student
Content: Theme 1: Techniques in Food industries (breweries, dairies, wines etc.): Fermentation Technology; Yeast based products; Bacteria based fermented products; Mold based products and other microbial based products such as sweeteners, flavours, amino acids, vitamins.
Theme 2: Safety evaluation of novel food products and food fortification
Theme 3: Bio engineering: Genetically modified foods; New Frontiers for Food Processing; Advances in Lactic Acid Bacteria for Novel applications
Theme 4: Food industrial wastes
Theme 5: Functional foods; Prebiotics and probiotics ingredients
Theme 6: Indigenous food technology
Practical aspects and skills that will be addressed during the teaching of the various themes include

- Isolation, purification and maintenance of yeast and bacterial cultures.
- Aerobic and anaerobic fermentation.
- Production of various fermented food products
- Identification of microorganisms (molecular methods)
- Production of metabolites and enzymes: detection of enzymes and bacteriocins

MMF5911Food Microbiology

Course Title: **Food Microbiology**
Code: **MMF5911**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Continuous assessment will be composed of the graded reports during laboratory presentation as well as 2 assignments that will be presented orally and 1 written assignment. Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student
Content: Theme 1: Growth conditions for bacteria.
Theme 2: Microbes in foods: Sources of Microorganisms in Foods; Food spoilage; pathogens; Beneficial Bacteria; Characteristics of Predominant Microorganisms in Food; Food Ingredients and Enzymes of Microbial Origin; Food Standards and Food Environment
Theme 3: Food Biopreservatives of Microbial Origin
Theme 4: Microbiology of Fermented food: Microorganisms Used in Food Fermentation
Theme 5: Prebiotics and probiotics
Practical aspects and skills that will be addressed during the teaching of the various themes include

- Microbial techniques (spoilage organisms, pathogens, fermented foods)
- Detection and Enumeration of micro-organism in food samples
- Isolation and enrichment of microorganisms
- Identification of microorganisms (biochemical methods)
- Use of automated rapid and conventional methods for microbial toxins, metabolites, inhibitory substances, pathogens and bacteriophages through HPLC and GC.

MMF5921Food safety

Course Title: **Food safety**
Code: **MMF5921**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3-hour paper)
Prerequisites: Must be a registered postgraduate student
Content: The content for this course will include topics such as: Transfer of pathogens from environment to food, the HACCP system, ISO standards, preservation techniques, quality control, food processing, radiation, water quality control, From harvesting or farms to consumer: chemical, microbiological and technological aspects of food; Microbial indicators in Food; Foodborne pathogens and illnesses; New and Emerging Foodborne Pathogens; Food toxicology (Microbiological toxins, Intolerance and allergy to food); Adverse Effects of Food and Nutrition; Risk analysis in relation to food and its components; Food protection and defense: bioterrorism and genetically modified organisms and potential dangers in packaging and labeling of food products; Food safety regulations in Namibia and elsewhere in the World (globally) – International Food laws and regulations.

MMF5922Climate Change and Food Security

Course Title: **Climate Change and Food Security**
Code: **MMF5922**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3-hour paper)
Prerequisites: Must be a registered postgraduate student
Content: The content for this courses will include topics such as: Evidence analysis and predictions on overall negative or positive effects microorganism changes on agricultural production as a result of climate change, effects of Climate on pests and pathogens affecting agricultural crops; crop–pest/pathogen models in prediction of changes in pest/pathogen dynamics, design sound plant

health management practices, climate change and increase risk to food and feed contaminated by mycotoxin-producing fungi. Use of transgene(s) enhanced adaptation to abiotic stresses that are exacerbated by climate change. Relationship of microbes, Climate change and declining nutritional quality of food crops. The use of high-throughput phenomic platforms to relationships of microbes measure plant growth and development and analyze nutritional traits, development of climate resilience production systems; Sustaining food quality by manipulating soil microbial Diversity Increased use of agro biodiversity and generation of agro biodiversity to coping with adverse impacts climate change.

MME5912Microbiology of wastewater

Course Title: **Microbiology of wastewater**
Code: **MME5912**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Continuous assessment will be composed of the graded report during laboratory presentation as well as 2 assignments that will be presented orally and 1 written assignment. Continuous assessment 50%, Examination 50% (1 x 3 hour paper).
Prerequisites: Must be a registered postgraduate student
Content: Theme 1: Sources and typical characteristics of Wastewater: Domestic wastewater, industrial wastewater (food and beverage industry, chemical industry, tanneries, textile industry etc), agricultural run-off. **Theme 2:** Environmental consequences of not treating wastewater: eutrophication in surface water, groundwater contamination, pollution with pathogens, toxic chemicals in water, presence of endocrine disrupting chemicals. The use of indicator organisms to determine water quality using culturing techniques and selective media as well as molecular techniques.**Theme 3:** Overview of a sewage treatment plant: description of typical aerobic and anaerobic processes and a detailed study of the biology of microorganisms involved in these processes, including nitrification, carbon removal, denitrification and phosphate removal. Detailed study of the biology and importance of microorganisms in clarifiers and those that can be utilized in post-treatment of sludge. Microbial processes in waste stabilization ponds. **Theme 4:** Operational procedures and their importance to microbial processes, such as the sludge retention time, hydraulic retention time, sludge loading rate, Feed ratios and the importance and processes of on-line monitoring in wastewater treatment plants. **Theme 5:** Necessary adaptations of a sewage treatment plant for the treatment of various industrial wastewaters, focusing on the microbiological processes in such plants such as the use of microorganisms for toxicity testing. **Theme 6**: Reclamation of wastewater for drinking water production and microbial aspects and processes in drinking water treatment and distribution. Theme 7: Water and Public Health.

MMM5911 Microbial Principles and Processes

Course Title: **Microbial Principles and Processes**
Code: **MMM5911**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Students will submit written practical assignments and one case study presentation and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3-hour paper)
Prerequisites: Must be a registered postgraduate student
Content: Theme Poverty related diseases in Namibia; including neglected tropical and zoonotic diseases; Ethiology and pathogenesis; host innate and adaptive immunity; Epidemiology and ecology; Treatment in humans and animals, including livestock and companion animals

MMM5932 Climate Change and emerging diseases

Course Title: **Climate Change and emerging diseases**
Code: **MMM5932**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Students will submit written practical assignments and one case study presentation and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3-hour paper)
Prerequisites: Must be a registered postgraduate student
Content: Theme Emerging and re-emerging infectious diseases and occurrence; transmission cycles for infectious diseases; historical evidence for climate change and the link between climatic conditions and infectious diseases; the phenomenon of global warming; observed and predicted impacts of long-term climate change.

MMM5912 Molecular Microbiology and Biotechnology

Course Title: **Molecular Microbiology and Biotechnology**
Code: **MMM5912**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Students will submit written practical assignments and one case study presentation and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3-hour paper)
Prerequisites: Must be a registered postgraduate student
Content: Theme Drug development, biosprospecting, Vaccine development (Viral vaccines: conventional: killed/attenuated; DNA; peptide; recombinant protein Sterilization techniques: biohazard hoods; containment facilities) Bacterial and viral vectors, Biological warfare agents, insulin production, molecular techniques, beneficial microbes and their potential use, biomedicines, Mode of action of antibiotics and antivirals: molecular mechanism of drug resistance (MDR), indigenous practices, climate change and emerging diseases, Gene therapy-concept, vectors, gene targeting and tissue-specific expression, Ethics and human genetics (Social- genetic discrimination: human cloning, foeticide, sex determination, Ethical: somatic and germ line gene therapy, clinical trials, the right to information, ethics committee function), pharmacogenomics and toxicogenomics, Cellular therapy; Stem cells, Recombinant therapy, Immunotherapy, Patenting and Intellectual property rights.

MMM5931 Clinical Microbiology and Diagnostics

Course Title: **Clinical Microbiology and Diagnostics**
Code: **MMM5931**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Students will submit written practical assignments and undertake written tests during the semester; this will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student
Content: The course will be organized into four themes:
- Organization and function of the clinical microbiology laboratory;
- Handling clinical specimens for microbiological studies;
- Aetiological agents recovered from clinical material; and
- Methods for identification of aetiological agents of infectious and non-infectious diseases.

MME5911Environmental Biotechnology

Course Title: **Environmental Biotechnology**
Code: **MME5911**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Students will submit written practical assignments and undertake written tests during the semester; this will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student
Content: THEME1: MICROBIAL INTERACTIONS AND THEIR ROLE IN THE ENVIRONMENT:
Mobilization and immobiilisation of carbon with rhizosphere; mechanism of biological nitrogen fixation, ammonification, nitrification, denitrificatioin and microorganisms involved in such processes; Biofertilizer for sustainable agriculture *Rhizobium Azospirillium, Azotobacter*,*Azolla*, applications methods of biofertilizers - significance of biofertilizers.
THEME2: POLLUTION, ITS MONITORING AND CONTROL: Sources, major pollutants, adverse effect on living organisms; acid rain and its impact on ecosystem-gaseous emission; Droplet neuclei –Aerosol; Assessment of air quality; Airbone diseases, their symptoms and preventive measures; Types of wastes, characterization of solid and liquid waste; Brief account on bioterrorism.
THEME3: BIOREMEDIATION: Use of Biotechnology and commercial blends of Microorganism and Enzymes in wastewater treatment; Solid waste treatment
THEME 4: BIODEGRADATION OF POLLUTANTS AND RECALCITRANT COMPOUNDS: Principles of Bioremediation: Phytoremediation of xenobiotics and bioaccumulation of metals using plants; Biodegradation of petroleum constituents and associated heavy metals; • Phytoremediation of soil contaminated with toxic metals and radionucleids; • Entrapped microbial cultures and their utility in environmental biodegradation process.; Application of Recombinant DNA technology in waste treatment; Application of genetically engineered microbes; Microbial leaching and mining; Biosensors in Detection of Environment Pollutants; Biopesticides and Biofertilizers
THEME 6: Biodiversity and Biotechnology: Cellular and molecular aspects of Biotechnology; Reforestation through micro-propagation; Biotechnology in preservation of bio-diversity; In situ and ex situ conservation through gene banks; Genetically modified plants and the environment.
THEME 7: BIOENERGETICS

MME5921 Geo-Microbiology and biogeochemistry

Course Title: **Geo-Microbiology and biogeochemistry**
Code: **MME5921**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Continuous assessment will be composed of the graded report during laboratory presentation as well as 1 written assignment and 1 assignment that will be in the form of an oral presentation. Continuous assessment 50%, Examination 50% (1 x 3 hour paper)**Prerequisites:** Must be a registered postgraduate student
Content: Theme 1: Thermodynamics of microbial processes (free energy, electrode potentials, energy conservation such as phosphorylation) and redox cascades in sediments which affect microbial metabolism. **Theme 2:** Measurement and calculation of fluxes between water, sediment and microorganisms. **Theme 3:** Geomicrobiological methods: Use of stable isotopes and biomarkers, microsensors, RT-PCR, DGGE, FISH, CARD-FISH, flow cytometry etc. **Theme 4:** The role of microorgansms in geochemical cycles: Carbon, nitrogen, phosphorus, sulfur cycles, iron and manganese. **Theme 5:** Role of microorganisms in geological processes: Microbial dolomite precipitation, Acid Mine Biogeochemistry, Anaerobic oxidation of methane, Geomicrobiology of fossil fuels.

MME5932 Climate change and Microbial Biodiversity

Course Title: **Climate change and Microbial Biodiversity**
Code: **MME5932**
NQF Level: 9
Contact hours: 56 hours lectures and 42 hours practical
Credits: 24
Course Assessment: Students will submit written practical assignments and at least 1 test during the semester that will form part of continuous assessment. Weighting: Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Content: Theme 1: Role of microorganisms in controlling the climate via the carbon, nitrogen and sulfur cycles e.g. contribution of microbial processes in ruminants to methane in the atmosphere, the role of nitrogen fixing bacteria in the oceans and soils etc. Climate change versus climate variability.**Theme 2:** Climate change and health – the effect of climate change on the pathology and spread of diseases such as malaria. **Theme 3:** Effect of climate change on the diversity, distribution and abundance of microorganisms and on microbial processes. **Theme 4:** the role of microorganisms in climate change adaptation and mitigation e.g. the production of alternative biofuels; Climate change impact on Marine , soil and Terrestrial Biodiversity in relation to microorganism changes.

MME5922 Extremophiles

Course Title: **Extremophiles**
Code: **MME5922**
NQF Level: 9
Contact hours: 28 hours lectures and 21 hours practical
Credits: 12
Course Assessment: Continuous assessment will be composed of the graded report during laboratory presentation as well as 1 assignment that will be presented orally and 1 written assignment. Continuous assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisites: Must be a registered postgraduate student

Content: Theme 1: Thermophiles: Biotopes; Isolation and physiology of thermophiles; Biochemical basis of thermophily; Biotechnological perspective; Enzymes in thermophilic microorganisms and other adaptations that allow them to survive in high temperature environments. **Deserts:** Classification, hyperthermophilic habitats and ecological aspects; Extremely Thermophilic Archaebacteria, Thermophily, commercial aspects of thermophiles; Applications of thermozymes; Methanogens: Classification, Habitats, applications. **Hydrothermal vents:** Examples of hydrothermal vents and the processes that lead to their formation, Conditions at hydrothermal vents, primary production through chemosynthesis at hydrothermal vents and the role of microorganisms in support in vent ecosystems; Strategies for survival at hydrothermal vents; Diversity and physiology of microorganisms at hydrothermal vents including processes of sulfide and methane oxidation.

Theme 2: Halophiles and Barophiles: Hyper-saline environment; Taxonomic distribution and isolation of halophiles Physiology of extreme halophiles and barophiles; Barophiles: Classification, high-pressure habitats, life under pressure, barophily, death under pressure.

Theme 3: Acidophiles and Alkaliphiles: Occurrence of life at low and high pH; Isolation and enumeration of acidophiles and alkalophiles; Physiology of microbial adaptation to extreme pH; Bioleaching and bio-beneficiation of mineral-ores

Theme 4: Oxygen-free environments: Oxygen minimum zones in the environment and the redox potentials existing as well as the diversity of microorganisms in such anaerobic conditions, Anaerobic microbial processes in anoxic environments: methanogenesis, sufate reduction, anaerobic oxidation of methane, denitrification, anaerobic oxidation of ammonium (ANNAMOX)

Theme 5: Psychrophiles: Enzymes of phychrophiles; Distribution and isolation; Mechanisms and molecular aspects of psychrophiles

MMB5900 Thesis

Course Title: **Thesis**
Code: **MMB5900**
NQF Level: 9
Contact hours: Face to face consultations with supervisors on a regular basis
Credits: 120
Course Assessment: The written thesis makes up 100% of the final thesis mark

Content: The content and nature for the thesis will depend on the topic of research selected by the student. Students will engage in independent research within industries, laboratories and the field through attachments.

D.11 MSC AND PHD BY THESIS (BIOCHEMISTRY AND MICROBIOLOGY)

11.1. ADMISSION REQUIREMENTS

Students must be in possession of NQF level 8 Honours degree to be admitted for MSc by thesis or NQF level 9 Master's degree for PHD by thesis from a recognized institution. In addition, students must submit a well-written concept note developed together with a prospective supervisor in the Department of Biochemistry, Microbiology and Biotechnology.

11.2. DURATION OF STUDY

The duration of the programme for MSc by thesis is usually two (2) years for full-time students and three years for Part-time students. The Duration for PhD students is normally three (3) years for full-time students and four (4) years for part-time students.

11.3. ADDITIONAL INFORMATION

Additional information can be found in the prospectus of the Centre for Postgraduate Studies

E. DEPARTMENT OF ENVIRONMENTAL SCIENCES

E.1. DEPARTMENTAL REGULATIONS

E.1.1. Programs Offered in the Department

The Department of Environmental Sciences offers the following undergraduate Programs: Diploma in Natural Resources Management (17HDNR) and Bachelor of Science in Integrated Environmental Science (Honours) (11BSIE) offered at Ogongo Campus and Bachelor of Science in Environmental Biology (Honours) (11BMBL), Bachelor of Science in Geo-Information Science (Honours) (13BGIS) with Specialization in Geography and Environmental Studies or Biology) and Bachelor of Science in Environmental Biology (Honours) - (Articulation), offered at the Main Campus in Windhoek.

E.2 DIPLOMA IN NATURAL RESOURCES MANAGEMENT (OGONGO CAMPUS) [17HDNR]

E.2.1 GENERAL ADMISSION CRITERIA FOR UNDERGRADUATE PROGRAMMES

E.2.1.1 DIPLOMA PROGRAMME

E.2.1.2 The normal basic requirement for entrance to Diploma programme shall be a Namibian Senior Secondary Certificate (NSSC) Ordinary Level or a recognized equivalent qualification, provided that a candidate has passed five subjects with a minimum of 22 points on the UNAM Evaluation Point Scale. The following minimum requirements will apply:

i) English (as a Second Language) with a "D" symbol or better;
ii) Mathematics with a "D" symbol or better;
iii) **Diploma in Natural Resources Management**: Any two of the following: a minimum <u>"D" symbol Biology; a minimum "D" symbol in Agricultural Science; a minimum "E" symbol in Physical Science or Geography;</u>
iv) For Diploma in Animal Health: Any two of the following: a minimum "D" symbol in Biology; a minimum "D" symbol in Agricultural Science; a minimum "E" symbol in Physical Science (or Chemistry);
v) Candidates may also be admitted into the above Diploma Programmes through the Mature Age provision if they meet the following conditions:

a) They should be at least 25 years old on the first day of the academic year in which admission is sought;
b) They should have successfully completed junior secondary school education (i.e. grade 10);

c) They should have proof of at least five years of relevant work experience;

d) They should pass all papers of the prescribed Mature Age Entry tests with a minimum of 50%.

E.2.1.3 Meeting the minimum admission requirements does not necessarily ensure admission. Admission is based on the number of places available and is awarded on the basis of merit after a rigorous selection process. The Faculty reserves the right to interview candidates before admission.

<u>E.2.2 PROGRAMME SCHEDULE</u>

Year 1

CODE	COURSE	NQF Level	CREDITS	PRE-REQUISITES	CO-REQUISITES
	Year 1 Semester 1				
LEG2410	English for General Communication	4	16		None
CLC3509	Computer Literacy	5	8		None
CSI 3580	Contemporary Social Issues	5	8		None
AEC 2411	Mathematics and Basic Statistics	4	16		None
ASC 2431	Biology	4	16		None
	Year 1 Semester 2				
IES 2402	Nursery Management	4	8		None
IES 2422	Plant Taxonomy	4	8		None
IES 2442	General Ecology	4	8		None
AEC 2482	Basic Economics	4	12		None
ASC 2432	Physical Science	4	16		None
Total Credits			**132**		

Year 2

CODE	COURSE	NQF Level	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 2 Semester 1					
IES 2531	Introduction to Agroforestry	5	16		None
IES 2551	Forest and Veld Fire Management	5	16		None
AEC 2501	Financial Management	5	8		None
AEC 2521	Introduction to Rural Sociology	5	8		None
AEC 2541	Communication & Information Systems	5	8		
CSC 2581	Soil Science	5	12		None
Year 2 Semester 2					
IES 2582	Vegetation Assessment & Monitoring Techniques	5	12		None
IES 2502	Plant Pathology	5	8		None
IES 2542	Silviculture	5	8		
IES 2562	Applied Entomology	5	8		None
CSC2582	Introduction to Research	5	12		None
CSC2592	Crop Production	5	12		None

Year 3

CODE	COURSE	NQF Level	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 2 Semester 1					
IES 2651	Natural Resources Policies & Administration	6	16		None
IES 2671	Forest Products & Services	6	16		None
AEC2641	Principles of Agricultural Extension	6	8		None
CSC2601	Water Management & Soil Conservation	6	8	ACSC2581	
ACA2601	Field Attachment	6	8		None
ASC2600	Special Study	6	8	CSC 2582	
Year 2 Semester 2					
AIES 2632	Natural Resource Management	6	16		None
AIES 2652	Principles of Wildlife Management	6	16		None
AIES 2672	Economics of Natural Resources	6	8		None
AAEC2602	Project Management	6	8		None
A ASC2600	Special Study	6	8		None
AIES 2632	Natural Resource Management	6	8	AASC 2582	None
Total Credits			**128**		

E.2.3 MODULE DESCRIPTORS

E.2.3.1 FIRST YEAR MODULES

LEG 2410: ENGLISH FOR GENERAL COMMUNICATION

Module title: ENGLISH FOR GENERAL COMMUNICATION
Code: **LEG 2410**
NQF Level: 4
Contact hours: 4 hours per week for 28 weeks
Credits: 32
Module Assessment: Continuous Assessment (60%): 4 reading tests, 4 writing tests, 2 oral presentations, 1 literature worksheet. Examination (40%): 1x3 hour paper
Pre-requisites: None
Module Content:
This module attempts to assist students to improve their general English proficiency. The main goal of this module is, therefore, to develop the reading, writing, listening, speaking and study skills of students in order for them to perform tasks in an academic environment. This module focuses on the skills students need to perform cognitive academic tasks in an academic environment and beyond.

CLC3509 COMPUTER LITERACY

Module title: **COMPUTER LITERACY**
Code: **CLC3509**
NQF level: 5
Contact hours: 1 lecture theory and 1 lecture practical per week for 14 weeks
Credits: 8
Module assessment: Continuous Assessment 100%: 2 Practical Tests 50%, 2 Theory Tests 50%
Prerequisites: University Entry

Module Content:

The aim of this module is to equip the students through hands-on experience with the necessary skills to use application software: word processing, spreadsheets, databases, presentations and communications. The objective is to increase student's productivity in both the education and later, the work environment. The module covers the following topics. Introduction to Computers: hardware and software, types and categories of computers, usage of Computer devices and peripherals. Working with the windows operating system: File Management, working with multiple programs, using the recycle bin. Using a word processor: formatting a text and documents, spelling check, grammar and thesaurus tools, inserting tables, auto-shapes, clip arts, charts, and mail merge. Spreadsheet: worksheets and workbooks, ranges, formulas and functions, creating graphs, charts, and printing the workbook. Databases: creating tables, relationships, queries, forms and reports. Presentation software: slide layout and master, animations, auto-content wizard and templates. Communication tools: introduction to the Internet, web browsers, search engines, downloading and uploading files, creating and sending messages, email etiquette, internet security, and digital signatures.

CSI 3580 CONTEMPORARY SOCIAL ISSUES

Module Title:	CONTEMPORARY SOCIAL ISSUES
Code	**CSI 3580**
NQF Level	5
NQF Credits	8
Contact hours	Equivalent to 1 hour per week for 2 semesters (Online)
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1&2

Module Content:
The module, Contemporary Social Issues (CSI3580), is designed to encourage behavioural change among UNAM students and inculcate the primacy of moral reasoning in their social relations and their academic lives. In providing students with critical and analytical thinking the module enables students to grow and develop into well rounded citizens, capable of solving contemporary social challenges experienced in their communities and societies. The teaching of the module takes three dimensions: the intellectual, the professional and the personal dimensions. The intellectual dimension is fostered through engaging students with subject knowledge, independent learning and module assessment. The professional dimension, on the other hand, is fostered through exposing students to real life situations of case studies and practical exercises that draws attention to social issues that attract ongoing political, public and media attention and/or debate. Finally, the professional dimension is fostered through group work, online discussions and class participation.

Assessment Strategies:
* Continuous flexible modes of assessment (100%).

The purpose of this evaluation is to assess whether the teaching of the course has resulted in the accomplishment of the aims of the course in each student. This evaluation is therefore focused on assessing the impact of the course in individual students. Various methods can be used: written tests, multiple choice quizzes, assignments or brief reports, case analyses, presentations, essays, or reflections upon a theme or topic. Students should be graded based on continuous flexible modes of assessment (100%), and the Course Coordinator in consultations with the lecturers shall select the same written tests, multiple choice quizzes, assignments or brief reports, case analyses, presentations, etc. that shall be given to the students throughout the year.

*** Profile or Student's File:**
It is required from each lecturer to keep proper profile or student's file where all the written assignments shall be kept. The student has the right of access to her/his profile during the Academic Year. At the end of the Academic Year the average percentage shall be work out based on the continuous flexible modes of assessment.

*** Evaluation of the lecturer:**
After completion of the course the teaching should be evaluated. Students shall be invited to provide feedback on the teaching of lecturer/lecturers. The purpose of this evaluation is to identify how the course and the teaching can be improved.

AEC 2411: MATHEMATICS AND BASIC STATISTICS

Module Title:	**MATHEMATICS AND BASIC STATISTICS**
Code	**AEC 2411**
NQF Level	4
NQF Credits	16
Assessment Strategies	Continuous assessment 60% (minimum 2 tests and 1 assignment); Examination 40% (1 x 3 hour paper)
Contact hours	4 hours lectures per week; 3 hours tutorials alternate week for 14 weeks
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:
Numbers; Operations; Percentages; Conversion of fractions and decimals; Ratio; Rate; Proportion and scale; Algebraic representation and formulae; Equations; Indices; Measurements and conversion of units; Geometrical terms and relationships; Bearings; Tables and graphs in practical situations; Trigonometry; Basic statistics: Population and sampling; Probability sampling methods; Measures of central tendencies; Measures of dispersion: Frequency distribution (grouped and ungrouped) data; Probabilities; Regression and correlation; Analysis of variance (ANOVA); Presentation and interpretation of statistical results and information.

ASC 2431: BIOLOGY

Module Title:	**BIOLOGY**
Code	**ASC 2431**
NQF Level	4
NQF Credits Assessment	16
Strategies Contact hours	Continuous assessment 60% (minimum 2 tests and 1 assignment); Examination

	40% (1 x 3 hour paper) 4 hours per week lectures; 3 hours per week practical's for 14 weeks
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:

Chemical basis of life; Introductory structure of macromolecules and their functions Prokaryotic and eukaryotic cells; Overview of the five major kingdoms of organisms and Viruses; Basic plant and animal anatomy and physiology: Differences between plant and animal cells; Photosynthesis; Osmosis & diffusion, cell respiration, passive and active transport; Basic taxonomy, Basic concepts of Mendelian genetics: Cell cycle; Mitosis and Meiosis; Sexual and asexual reproduction; Introduction to ecology, ecosystems and communities; Naming of ecosystems and communities; Food chain and food web; Interrelationships among organisms.

AEC2482: BASIC ECONOMICS

Module Title:	**BASIC ECONOMICS**
Code	**AEC2482**
NQF Level	4
NQF Credits	12
Assessment Strategies	Continuous assessment 60% (minimum 2 tests and 1 assignment); Examination 40% (1 x 2 hour paper)
Contact hours	3 hours lectures and 2 hours practical per week for 14 weeks
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:

Definition and scope of economics and agricultural economics; Micro- and macro-economics; Economic systems; Factors influencing demand and supply of agricultural commodities; Elasticity of demand and supply; Price determination under different market structures; Production functions; Cost concepts; Optimal level of output and input use; Risk and uncertainty; Tools used in macroeconomic analysis: the theory, measurement, and determination of national income; taxation; employment and business cycles; the multiplier; fiscal policy, budget deficits, and the national debt; aggregate supply and aggregate demand; money, banking, and monetary policy; exchange rates and balance of payments accounts; and stabilization policy for unemployment and inflation, introduction to international trade and comparative advantage.

ASC 2432: PHYSICAL SCIENCE

Module Title:	**PHYSICAL SCIENCE**
Code	**ASC 2432**
NQF Level	4
NQF Credits	16
Assessment Strategies	Continuous assessment 60% (minimum 2 tests And 1 assignment); Examination 40% (1 x 3 hour paper)
Contact hours	4 hours per week lectures; 3 hours practical for 14 weeks
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:

Laboratory safety. Physical quantities and measurements –SI. Properties of matter; Atoms, elements, molecules & compounds; The Periodic Table; Chemical formulae; Covalent and ionic compounds; non-polar and polar molecules; Molecular and formula mass; Redox reactions; Moles and Molarity; Octet rule; Electronic bonding & orbitals; Lewis structures; Chemical reactions and equations; Balancing chemical equations; Stoichiometry; Acids and bases; pH & buffers; Solutions and Solubility; Structure and properties of water; Ionisation of water; Laws of motion, force, energy, work. Kinetic theory of gases; Gas laws, pressure; Basic electricity; Voltage, current, power, conductors, insulators. Thermodynamics and heat; conduction, radiation and convection

IES 2402: NURSERY MANAGEMENT

Module Title:	**NURSERY MANAGEMENT**
Code	**IES 2402**
NQF level	4
NQF Credits	8
Assessment strategies	Continuous assessment 60% (minimum 2 tests, 2 assignments, 5 assessed practical's; Examination 40% (1 x 2 hour theory paper). 2 hours of lectures per week, 3 h practical's alternate week
Contact hours	2 hours of lectures per week, 3 h practical's alternate week
Prerequisites	None
Compulsory/Elective	Compulsory
Semester offered	2

Module Content

Introduction to silviculture. Forest nurseries. Types of forest nurseries: permanent, temporary, satellite and flying nurseries. Selection of nursery site. Seedlings growing media. Seed technology: history of seed production, forecasting seed yield, seed collection and extraction, seed testing, computation of seeds requirements and seed storage. Seed sowing. Vegetative propagation: definition, types and techniques of vegetative propagation. Nursery tending operation. Nursery protection. Seedling distribution. Nursery records. Nursery planning, work organization and administration.

IES 2422: PLANT TAXONOMY

Module Title:	**PLANT TAXONOMY**
Code	**IES 2422**
NQF level	5
NQF Credits	8
Assessment strategies	Continuous assessments 60% (minimum 2 tests, 4 assessed practical and 1 assignment); Examination 40% (1 x 2 hour theory paper).
Contact hours	2 hours of lectures per week, 3 h practicals per week
Prerequisites	General Biology

Compulsory/Elective Compulsory
Semester offered 2

Module Content:

Introduction to botanical concepts and plant anatomy. Plant taxonomy; classification and nomenclature. Plants identification; trees, shrubs and herbs. Botanical keys; types and use. Major plant families in Namibia and Specimen collection; Fabaceae (3 sub-families), Euphorbiaceae, Rubiaceae, Combretaceae.

IES2442: GENERAL ECOLOGY

Module Title:	**GENERAL ECOLOGY**
Code	**IES2442**
NQF level	4
NQF Credits Assessment	8
Strategies Contact hours	Continuous assessments 60% (Minimum 2 tests, 3 practicals, 1 assignment). Examination 40% (1x2 hour theory paper). 2 hours of lectures per week, 3 h practicals alternate week
Compulsory/Elective	Compulsory
Semester offered	2

Module Content:

Introduction to ecology: Concepts of ecology. Ecosystems of arid zones: terrestrial, freshwater and marine. Biomes of Southern Africa: physical and climatic characteristics. Constituents of the ecosystem: Biotic and abiotic components. Nutrient cycles: Food chain, Nitrogen cycle, Phosphorus cycle and carbon cycle. Plant succession and ecosystem disturbance. Ecosystem maintenance/conservation.

E.2.3.2 SECOND YEAR MODULES

IES2531: INTRODUCTION TO AGROFORESTRY

Module Title:	**INTRODUCTION TO AGROFORESTRY**
Code	**IES2531**
NQF level	5
NQF Credits	16
Assessment strategies	Continuous assessments 60% (2 tests, 4 practical reports, assignments); Examination 40% (1 x 3 hours paper).
Contact hours	4 hours of lectures per week, 3 hours of practicals per week
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:

Introduction to agroforestry: Definition and principles of agroforestry, integrated land-use system, need for agroforestry, cause and consequences of deforestation. Multi-purpose tree species and their uses. Agroforestry systems. Agroforestry establishment techniques; ecological and economic interactions. Indigenous fruit trees. Agroforestry project work. Principles of beekeeping: biology of honeybees, beekeeping management, honey and other bee products. Crop pollination, bee diseases, parasites and poisoning of honeybees and their control.

IES2551: FOREST AND VELD FIRE MANAGEMENT

Module Title:	**FOREST AND VELD FIRE MANAGEMENT**
Code	**IES2551**
NQF level	6
NQF Credits Assessment	16
Strategies Contact hours	Continuous assessment 60% (minimum 2 tests, 1 assignment, 2 graded practical, 1 field trip report, 1 fire management plan). Examination 40% (1 x 3 hours theory paper). 4 hours of lectures per week, 3 hours practicals per week
Compulsory/Elective	Compulsory
Semester offered	1

Module Content:

Introduction to veld and forest fires: definition of veld and forest fires, significance of veld and forest fires in savanna management, Forest fire and the environment: causes of fires, types of fires, effects of fire, forest fuels, fire behaviour, fire danger rating system, rate of spread, parts of veld and forest fire, classification of veld and forest fires. Fire prevention: community participation in fire prevention, early controlled burning, principles of fire breaks and fire break maintenance, fire protection plan. Fire detection: general detection, organized detection, fire lookout personnel, communication. Fire suppression: Tools, equipment and techniques, phases of fire suppression tactics, basic rules of fire. Suppression tactics, methods of fire attack, factors affecting choice of attack, principle techniques for fire line construction, fire reports and records. Uses of fire in forest and range management: protective tool, land clearing, grazing, other uses. Fire control organization: functions of fire control section, personnel and their specific duties, the Government and other stakeholders. Safety and survival methods: general safety measures, accident prevention, firefighting safety rules, dangerous situations, welfare of the firefighting crew.

AEC 2521: INTRODUCTION TO RURAL SOCIOLOGY

Module Title:	**INTRODUCTION TO RURAL SOCIOLOGY**
Code	**AEC 2521**
NQF Level	5
NQF Credits	
Assessment Strategies	Continuous assessment 60% (minimum 2 tests and 1 assignment); Examination 40% (1 x 2 hour paper)
Contact hours	2 hours lectures and 2 hours practical alternate week for 14 weeks.
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:
Concepts of sociology and anthropology; the role of rural sociology in development; types of communities; leadership structure ; community based organisation (CBO); nongovernmental organisations (NGO); the social institution of communities; culture relativism; rural leadership, social change and rural development, indigenous knowledge ; rural poverty and wealth ranking; characteristic of rural and urban communities ; rural urban migration and implication for rural development; gender roles and property right in agriculture ; Impact of HIV/AIDS on Agriculture development.

AEC 2541: COMMUNICATION AND INFORMATION SYSTEMS

Module Title:	**COMMUNICATION AND INFORMATION SYSTEMS**
Code	**AEC 2541**
NQF Level	5
NQF Credits	8
Assessment Strategies	Continuous assessment 60% (minimum 2 tests and 1 assignment); Examination 40% (1 x 2 hour paper)
Contact hours	2 lecture hour per week and practical 2 hours alternate week for 14 weeks
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:
Definition of concepts, Theory of communication; the nature and importance of communication; Source, Message Channel and Receiver (SMCRE) communication models; communication process; verbal and non-verbal modes communication; written communication: writing informative articles and pamphlets for farmers; communication methods; extension campaigns; organization of agriculture show; and farmers day; Oral communication: effective speaking; presentation and use of common types of audio visual aids ; Application of ICTs in agricultural development, Design and production of communication materials. Information sourcing; scientific writing, referencing and plagiarism; Managing conflict and negotiation skills.

AEC 2501: FINANCIAL MANAGEMENT

Module Title:	**FINANCIAL MANAGEMENT**
Code	**AEC 2501**
NQF Level	5
NQF Credits	8
Assessment Strategies	Continuous assessment 60% (minimum 2 tests and 1 assignment): Examination 40% (1 x 2 hour paper)
Contact hours	2 lectures and 2 hours practical alternate week for 14 weeks
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:
Principles of financial Management; Budgeting and Record keeping; Risk management; Investment Analysis; Depreciation and Asset valuation; Financial Statements Analysis, Leasing and renting of equipment or assets; Income tax and Estate planning and legal aspects of borrowing and sources and terms of agricultural loans.

CSC 2581: SOIL SCIENCE

Module Title:	**SOIL SCIENCE**
Code	**CSC 2581**
NQF Level	5
NQF Credits	12
Assessment Strategies	Continuous assessment 60% (minimum 2 tests and 1 assignment) Examination 40% (1 x 2 hour paper)
Contact hours	3 hours lectures per week, 3 hours practical alternate week for 14 weeks
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:
Definition and importance of soil: mineral fraction, organic matter, soil water and air. Soil formation: types of rocks; processes of weathering. Soil physical and chemical properties: texture, density, porosity, soil aeration and temperature, structure, compaction, profile, water holding capacity, cation exchange capacity. Soil nutrients for plant growth: nutrient content and nutrient availability. Fertilizers: organic and inorganic. Soil water: movement and availability. Soil conditions: acidity, alkalinity, salinity. Soil types of Namibia. Agro-ecological zones of Namibia.

IES2582: VEGETATION ASSESSMENT AND MONITORING TECHNIQUES

Module Title:	**VEGETATION ASSESSMENT AND MONITORING TECHNIQUES**
Code	**IES2582**
NQF level	5
NQF Credits	12
Assessment strategies	Continuous assessments 60% (minimum 2 tests, 3 assessed practical, 1 inventory report); Examination 40% (1x2 hour theory paper).
Contact hours	3 hours of lectures per week, 2 hour practicals per week
Prerequisites	None
Compulsory/Elective	Compulsory
Semester offered	2

Module Content:
Introduction to vegetation assessments and inventory. Vegetation assessment: sampling: line transects, plot sampling: circular plots and quadrats; diversity indices; designs; result reporting. Forest mensuration systems, concepts and models. Tree measurement: measurement and computation of tree characteristics. Stand measurement. Inventories in large forest areas: Use Natural resource assessment methods to quantify and monitor changes in natural resources; Introduction to the use of Geographic Information System (GIS) tool for natural resource assessment.

IES 2502: PLANT PATHOLOGY	
Module Title:	**PLANT PATHOLOGY**
Code	**IES 2502**
NQF level	5
NQF Credits	8
Contact hours	2 hour of lectures per week, 3 hour practicals alternate week 3 hours lectures per week; 3 hours practicals/tutorials alternate week for 14 weeks
Prerequisite	None
Assessment strategies	Continuous assessments 60% (Minimum 2 tests, 4 graded practical reports, and 2 assignments). Examination 40% (1 x 2 hours paper).
Compulsory/Elective	Compulsory
Semester offered	2

Module Content:

Introduction to Plant Pathology. Non-infectious agents: Biology and diseases. Infectious agents: Biology and diseases. Concept of disease development. Disease identification. Diseases caused by fungi, bacteria and viruses. Common plant diseases in Namibia. Beneficial microorganisms. Disease prevention and control (management practices). Plant diseases and trading of plants and plant products.

IES2542: SILVICULTURE	
Module Title:	**SILVICULTURE**
Code	**IES2542**
NQF level	5
NQF Credits	8
Assessment strategies	Continuous assessments 60% (2 tests, 4 practical reports, and 2 assignments; Examination 40% (1 x 3 hours paper).
Contact hours	2 hour of lectures per week, 3 hour practicals alternate week
Prerequisites	AIES 2402: Nursery Management
Compulsory/Elective	Compulsory
Semester offered	2

Module Content:

Introduction: definitions and concepts, importance of establishing and tending of trees and forests. Land preparation methods. Forest establishment techniques. Weeding operations. Pruning operation. Thinning operation: reasons for thinning, thinning intensity and timing, thinning regimes, methods of thinning. Introduction to silvicultural systems: forms and composition of stands. Factors affecting the selection of a silvicultural system. Indigenous knowledge methods and their role in tending and management of indigenous trees and forests for better growth.

IES 2562: APPLIED ENTOMOLOGY	
Module Title:	APPLIED ENTOMOLOGY
Code	**IES 2562**
NQF level	6
NQF Credits	8
Assessment strategies	Continuous assessments 60% (Minimum 2 tests, 3 graded practical, and 1 assignment); Examination 40% (1 x 2 hour theory paper).
Contact hours	2 hour of lectures per week, 3 hour practicals alternate week
Prerequisites	None
Compulsory/Elective	Compulsory
Semester offered	2

Module Content

Introduction to Applied Entomology. General insect biology. Insect classification. Insects as pests. Assessment of insect population dynamics. Damage caused by insects/pests. Insects/pests in Namibian Forests. Beneficial insects. Preventive and control measures. Integrated pest management. Pests and trading of plants and plant products.

CSC 2582: INTRODUCTION TO RESEARCH	
Module Title:	INTRODUCTION TO RESEARCH
Code	**CSC 2582**
NQF Level	5
NQF Credits	12
Assessment Strategies	Continuous assessment 60% (minimum 2 tests and 1 assignment): Examination 40% (1 x 2 hour paper)
Contact hours	3 hours lectures per week; 3 hours practicals/tutorials alternate week for 14 weeks
Prerequisite	AAEC 2411 Mathematics and Basic Statistics
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:

Research process: research problem formulation, research objectives, hypothesis formulation, literature review, research methods. Work plans and budgets. Basic statistical concepts means, mode, median, standard deviations, coefficient of variation. Basic experimental designs: completely randomized, randomized complete block. Social Survey methods and planning and design of surveys and sampling (Simple random sample, cluster, multi-stage, and stratified), Questionnaire design, interview schedule, Organization of field work for social research work. Data collection methods, Individual/group Interviews.

CSC 2592: CROP PRODUCTION

Module Title:	**CROP PRODUCTION**
Code	CSC 2592
NQF Level	5
NQF Credits	12
Assessment Strategies	Continuous assessment 60% (minimum 2 tests and 1 assignment); Examination 40% (1x 2 hour paper)
Contact hours	3 hours lecture per week, 3 hours practical alternate week for 14 weeks
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:

Crop environment in Namibia. Cropping systems, tillage and crop establishment. Fertilization and management practices. Choice of land for different crops. Environmental factors affecting crop choice: temperature, rainfall, solar radiation, photoperiodism. Time of planting; pre- and post-rain planting. Land preparation: aims, tillage systems—conventional, minimum, conservation tillage. Review of tillage and cultivation equipment for large-scale and small-scale farmers. Seeding: factors affecting seed quality, seeding depth, seeding rate, plant population. Fertilizer application times and methods. Calculation of row and intra-row spacing and fertilizer rates. Cultural practices for weed control. Harvesting: physiological
maturity and harvest maturity, harvest index. Cropping systems— monoculture, mixed culture and intercropping. Soil requirements, climatic requirements and management practice for cereals; legumes, fibre crops, oil seed crops, root and tuber crops.

E.2.3.3THIRD YEAR MODULES

AIES2651: NATURAL RESOURCE POLICIES AND ADMINISTRATION

Module Title:	**NATURAL RESOURCE POLICIES AND ADMINISTRATION**
Code	**AIES2651**
NQF level	6
NQF Credits	16
Assessment strategies	Continuous assessments 60% (minimum of 2 tests, 2 practical reports, and 2 assignments); Examination 40% (1 x 3 hours theory paper).
Contact hours	4 hour of lectures per week, 3 hour practicals alternate week
Prerequisites	None
Compulsory/Elective	Compulsory
Semester offered	2

Module Content:

Definition of terms: Principal legislation, Subsidiary legislation, Act, policy, law, work plan. Objectives and strategies of formulating the policy. Introduction to the provisions of natural resources policies, laws and international conventions (emphasis Nature Conservation Act, Mining, Forest Act, Environmental Management Act and land reform acts; UN Conventions relating to natural resource conservation). Provision of natural resource regulations and procedures. Natural Resource policies and politics: Case studies from Namibia. Indigenous laws of Namibia related to environment conservation.

IES 2671: FOREST PRODUCTS AND SERVICES

Module Title:	**FOREST PRODUCTS AND SERVICES**
Code	**IES 2671**
NQF level	6
NQF Credits	16
Assessment strategies	Continuous assessments 60% (Minimum of 2 tests, 4 graded practical reports, and 2 assignments); Examination 40% (1 x 3 hours theory paper).
Contact hours	4 hours of lectures per week, 3 hours practicals per week
Prerequisites	None
Compulsory/Elective	Compulsory
Semester offered	1

Module Content:

INTRODUCTION: definitions of forests and related landscapes, wood forest products, non-wood forest products (NWFPs) and services; Contribution of forest products and services to local, national and international economy and trade.
FOREST PRODUCTS: Wood products harvesting techniques, extraction methods and processing in Namibia and in the world with special references to wood products in Namibia such as (fuelwood, charcoal and other wood energy, industrial round wood, sawn wood, pulpwood, particles and other industrial roundwood, fencing and other construction poles, handcrafts and traditional implements); Factors affecting harvesting, transportation system and processing of wood products (economic, social, political and environmental). Consumption rate of selected forest products (fuel wood, poles, etc)
NON-WOOD FOREST PRODUCTS (NWFPs): Contribution to household economy, local economy and food security (animal origin (food, medicine), plant origin (food and medicine), handcrafts, fodder); Factors affecting the development of indigenous natural products (INPs) and trade; Utilization and value addition of selected INPs (Devil's claw, marula fruit, hoodia plant, melons seed, Ximenia fruit, etc) FOREST SERVICES: Eco-tourism, recreation, spiritual and cultural uses; Environmental services: environmental protection of fragile ecosystems (drylands and uplands), combating desertification, watershed management, climate change (carbon sequestration), and biodiversity conservation.

ACSC 2601: WATER MANAGEMENT AND SOIL CONSERVATION

Module Title:	**WATER MANAGEMENT AND SOIL CONSERVATION**
Code	**ACSC 2601**
NQF Level	6
NQF Credits	8
Assessment Strategies	Continuous assessment 60% (minimum 2 tests and 1 assignment); Examination 40% (1 x 2 hour paper).
Contact hours	2 hours lectures per week, 3 hours practical alternate weeks for 14 weeks
Prerequisite	ACSC 2581 Soil Science
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:
The hydrological cycle, water sources and quality, uses and requirements. Water harvesting and storage. Soil erosion and soil loss estimation. Wind erosion and control. Conservation agriculture. Social, economic and institutional factors in water management and soil conservation planning. Overview or irrigation in Namibia. Soil/plant/water relationships. Crop water requirements. Irrigation methods. Drainage of agricultural lands.

AEC 2641: PRINCIPLES OF AGRICULTURAL EXTENSION

Module Title:	**PRINCIPLES OF AGRICULTURAL EXTENSION**
Code	**AEC 2641**
NQF Level	6
NQF Credits	8
Contact hours	2 hours lectures and 2 hours practical alternate week for 14 weeks
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:
Definition of extension and history of extension; role of agriculture extension worker; extension methods and nature of extension and development; the concept of adult learning; adoption and diffusion theory; opinion leaders and contact farmers; agricultural extension system and approaches: FSRE; group dynamics; establishing and strengthening farmer organisations and formation of new groups; Participatory Rural Appraisal (PRA) techniques; Theoretical perspective in extension program development, purpose and steps in planning process; Agriculture extension campaigns; Motivation theory (Maslow's Hierarchy of needs) plan of work coordination supervision and administration feedback and evaluation procedure

Assessment Strategies
Continuous assessment 60% (minimum 2 tests and 1 assignment); Examination 40% (1 x 2 hour paper)

ACA 2601: FIELD ATTACHMENT

Module Title:	**FIELD ATTACHMENT**
Code	**ACA 2601**
NQF Level	6
NQF Credits	8
Contact hours	6 weeks
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:
Three periods of , in total, six (6) weeks of field attachment will be undertaken by all Diploma students in one summer recess period (two are available: between the 1st and 2nd year and again between 2nd and 3rd year) and the winter recess in the 2nd year to gain practical experience and hands-on skills in support of teaching. During these periods, the students will be attached to suitable community forests, research stations, extension units and agro-industries in a structured, pre-planned manner to ensure that the objectives of off-site training are attained. Students will be visited during their attachment on-site to check on the efficiency of attachment. Twenty-one lecture hours (2 credits at level 5) will be allocated to this course for oral presentations.

Assessment Strategies
Assessment will consist of on-site inspection, a report by the field supervisor and a written report and oral presentation by the student.

ACA 2600: SPECIAL STUDY

Module Title:	**SPECIAL STUDY**
Code	**ACA 2600**
NQF Level	6
NQF Credits	16
Contact hours	2 hours per week for 28 weeks
Prerequisite	ACSC 2582: Introduction to Research
Compulsory/Elective	Compulsory
Semester Offered	1 and 2

Module Content:
Students carry out a supervised study of a current topic in Agriculture and related fields. The course includes participation in meetings organized by the coordinator, work with a faculty advisor to develop a study, formulate hypotheses, design and carry out experiments and collect data and write a report. Students will make a presentation to other students of the research proposal and a final presentation of the results.

Assessment Strategies
Research proposal write-up (20 %), presentation of the research proposal in seminar (10 %), presentation of empirical findings in a second seminar (10%), and final report (60 %).

IES 2632: NATURAL RESOURCES MANAGEMENT

Module Title:	**NATURAL RESOURCES MANAGEMENT**
Code	**IES 2632**
NQF level	6
NQF Credits	16
Contact hours	4 hours of lectures per week, 3 hours practicals per week
Prerequisites	
Compulsory/Elective	Compulsory
Semester offered	2

Module Content:

Introduction: definition and approaches; community, natural resources, resource integration and planning. Rural development and rural livelihood strategies. Natural resource management; Processes and procedures for community forestry, conservancy initiative formations. Policy and strategy frames relevant to community forestry and conservancies; Conflict management over natural resource use. Integrated natural resource management plan; concept and approaches, components and their interactions (land, water, forests, water, non-wood products and services). Methods and processes for integrated natural resource management plan formulation for water, rangelands and forests. Evaluation and monitoring methods for integrated natural resource management plan.
Assessment strategies
Continuous assessments 60% (minimum 2 tests, 4 practical reports, and 2 assignments); Examination 40% (1 x 3 hours theory paper).

IES 2652: PRINCIPLES OF WILDLIFE MANAGEMENT

Module Title:	**PRINCIPLES OF WILDLIFE MANAGEMENT**
Code	**IES 2652**
NQF level	6
NQF Credits	16
Contact hours	4 hours of lectures per week, 3 hours practicals per week
Prerequisites	None
Compulsory/Elective	Compulsory
Semester offered	1

Module Content:
An introduction to basic principles used in the management of wildlife populations, their habitats and their human users. General concepts in: ecological processes; population dynamics and structure; sampling in wildlife; life history patterns, biotic and abiotic factors structuring wildlife populations and endangered species. Home range and territoriality; coloniality; mating systems; hierarchy. Response of wildlife to humans. Plant-herbivore system. Herbivore-carnivore system. Predation of domestic animals by wild animals. Nutritional ecology (anatomy and physiology; feeding ecology; diet composition and analysis; nutritional value of plants; plant chemicals and toxins; management of toxic plants and affected game; grazing

and browsing capacity; mineral deficiencies and supplementary feeding; nutrition in captivity).Animals and their characteristics. Management techniques of wildlife. Rangeland management (principles and practices; inter-relationships between plant species, common range plants, cultivated pastures and fodders). Survey & Monitoring Techniques: atlasing, mapping method, line transect method, point count method, trap-retrap method; biases and errors; environmental variables.

Assessment strategies
Continuous assessment: 60% (at least three assessments); Exam: 40% (1 x 3 hr paper)

IES 2672: ECONOMICS OF NATURAL RESOURCES

Module Title:	**ECONOMICS OF NATURAL RESOURCES**
Code	**IES2672**
NQF level	6
NQF Credits	16
Contact hours	4 hours of lectures per week, 3 hours practicals alternate week
Prerequisites	AAEC 2482: Basic Economics
Compulsory/Elective	Compulsory
Semester offered	2

Module Content:
Introduction of natural resources economics. Classification of resources. Review of economic principles: scarcity. opportunity and environmental cost, costs of production, types of capital in relation to natural resources., price formation, capital and interest, depreciation. Economic analysis: Investment analysis, productivity, economic efficiency, uncertainty. Economic valuation of natural resources products and services; valuation techniques and surrogate markets; natural resources contribution to the national economy.

Assessment strategies
Continuous assessments 60% (minimum of 2 tests, 4 practical reports, and 2 assignments); Examination 40% (1 x 2 hours theory paper).

EC2602: PROJECT MANAGEMENT

Module Title:	**PROJECT MANAGEMENT**
Code	**AEC 2602**
NQF Level	5
NQF Credits	8
Assessment Strategies	Continuous assessment 60% (minimum 2 tests and 1 assignment); Examination 40% (1 x 2 hour paper)
Contact hours	2 hours of lectures per week and 2 hour practical alternate week 14 weeks
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:
Project as a means of developing rural areas. The project cycle; project identification, situation analysis: problem tree analysis. Project review (technical, institutional and managerial); Project environment: social, political, financial economic, commercial, legal and gender. Project design techniques (logical framework); Project implementation, management structure and resources; Project monitoring; project evaluation, type of evaluation. Examples of projects, Namibian projects, level of planning. Projects in the context of the regional and national development plan.

E.3 B.SC ENVIRONMENTAL BIOLOGY HONOURS

E.3.1. Programme REGULATIONS

E.3.1.1. ADMISSION REQUIREMENTS

To register for the **B.Sc Environmental Biology Honours** programme a candidate must hold a valid Namibian Senior Secondary Certificate (NSSC) (Ordinary or Higher) or a recognized equivalent qualification.
English is a compulsory subject and should have been obtained as a **second language** at NSSC (O level) with a **minimum C symbol** or **English** as a **first language** at NSSC (O level) with a **minimum D symbol**.
In addition to the above, admission to the **Bachelor of Science Honours**course requires at least a **symbol C** on NSSC or equivalent qualification in **Mathematics**; at least a **symbol C** on NSSC or equivalent qualification in **Biology** and at least a **symbol C** on NSSC or equivalent qualification in **Physical Sciences**.

A candidate should obtain a minimum of **25 points** on the **UNAM evaluation point scale** in his/her **five best subjects** (of which the above mentioned subjects must be included) to be admitted to undergraduate studies. **Obtaining the minimum number of points however, does not necessarily ensure admission**. **Admission is based on places available in courses, subjects and programs and is awarded on the basis of merit.**

Admission can also be considered for candidates who qualify through the **Mature Age Entry Scheme** upon successful completion of the relevant examinations as set out in the general regulations.

E.3.1.2. RE-ADMISSION REGULATIONS

To be re-admitted to the Faculty of Science for a particular year of registration, a student must have passed the minimum number of courses required as indicated below:

- **4** courses (equivalent to **64** credits) by the end of the **first year**; 2 of these courses (equivalent to **32** credits) must be non-core
- **8** courses (equivalent to **128** credits) by the end of the **second year**
- **15** courses (equivalent to **240** credits) by the end of the **third year**
- **23** courses (equivalent to **368** credits) by the end of the **fourth year**

A student will not be **re-admitted** into the Faculty if he/she has not passed the above courses.

E.3.1.3. PASS REQUIREMENTS

E.1.3.1. ADVANCEMENT AND PROGRESSION RULES

A student advances to the following academic level of study when at least **two thirds** of the courses of the curriculum for a specific year have been passed. If a student passed only **one third** of the full curriculum of a specific year, he/she may not register for any courses of the following year. In all cases **prerequisites** for courses have to be passed before a student can proceed to register for courses that require prerequisites.

From Year 1 to Year 2
- At least **7** courses (equivalent to **112** credits) prescribed for Year **1**

From Year 2 to Year 3
- All **first year** courses plus at least **6** courses (equivalent to **96** credits) prescribed for Year **2**

From Year 3 to Year 4
- All **second year** courses plus at least **5** courses (equivalent to **80** credits) prescribed for Year **3**

E.1.3.2. MAXIMUM NUMBER OF COURSES PER YEAR

No student will be allowed to register for more than **12** courses per year

E.3.1.4. COMPULSORY REQUIREMENTS

Lab coats are **compulsory** for practical sessions for all students.
Students pursuing **B.Sc. Honours in Environmental Biology** must DO and PASS the course **Field Ecology (SEBF3800)**. Failure to take part in these field-based courses will disqualify students from sitting the theory examination of the specific **co-requisite** courses.

E.3.1.5. WEIGHTING OF CA AND EXAM MARKS

- Unless otherwise indicated, the relationship between the **CA** mark and the Examination mark is **40:60.**

E.3.1.6 BACHELOR OF SCIENCE IN ENVIRONMENTAL BIOLOGY HONOURS

QUALIFICATION: B.Sc. in Environmental Biology Honours 11BEBL

YEAR 1

CODE	COURSE	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 1 Semester 1				
CLC3509	Computer Literacy	**8**		None
LCE3419	English Communication & Study Skills	**16**		None
MAT3511	Basic Mathematics	**16**		None
CSI3580	Contemporary Social Issues	**8**		None
BLG3511	Introduction to Biology	**16**		
GLY3521	Introduction to Physical Geology	**8**		
PHY3501	Physics for Life Sciences	**8**		None
Year 1 Semester 2				
MAT3512	Pre-Calculus	**16**		None
LEA3519	English for Academic Purposes	**16**		None
STS3522	Introduction to Statistics	**8**		None
CHM3532	Chemistry for Life Sciences	**16**		None
BLG3512	Diversity of Life	**16**		
GLY3502	Introduction to Earth Systems	**8**		
Total Credits		**128**		

YEAR 2

CODE	COURSE	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 2 Semester 1				
BLG3611	Animal Form and Function	**16**	BLG3511,BLG3512	None
MBL3631	Cell Molecular Biology and Genetics	**16**	BLG3511,BLG3512	None
BLG3621	Biometrics I	**8**	STS3522	BLG3622
EBL3631	Introduction to Ecology	**16**	BLG3511,BLG3512	None
GLY3621	Introduction to Hydrology	**8**	MAT3512**&**GLY3521	None
Year 2 Semester 2				
BLG3612	Plant Form and Function	**16**	BLG3511& BLG3512	None
MBL3632	Introduction to Microbiology	**16**	BLG3511& BLG3512	None
BLG3622	Biometrics II	**8**	STS3522	BLG3621
EBL3632	Ecological Field Techniques	**16**	BLG3511& BLG3512	None
GHE3682	Social Geography	**8**	None	None
Total Credits		**128**		

Year 3

CODE	COURSE	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 3 Semester 1				
BLG3701	Microbial Ecology	**8**	MBL3632, MBL3631	None
EBL3751	Aquatic Ecology	**16**	EBL3631	None
EBL3721	Biosystematics I	**8**	BLG 3611, BLG3612	None
EBL3771	Conservation Biology & Biodiversity	**16**	EBL3631	None
EBL3741	Ecological systems and climate change	**8**	EBL3631	None
GIS3711	Geographic Analysis & Techniques	**16**	GHE3682	None
Year 3 Semester 2				
EBL3712	Ecosystem Ecology	EBL3631	16	None
EBL3752	Ecophysiology	BLG 3611&BLG3612	16	None
EBL3722	Biosystematics II	BLG 3611,BLG3612	8	None
BLG3702	Research Methodology	BLG3621&BLG3622	8	None
GIS3732	Geographic Information Systems	GIS3711	16	None
Total Credits		**136**		

YEAR 4

CODE	COURSE	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 4 Semester 1				
BLG3810	Research Project	**32**	BLG3702	None
EBF3800	Field Ecology	**16**	EBL3771,EBL3751 EBL3712 &EBL3752	EBL3871, EBL3812,EBL3851, EBL3841, EBL3852
EBL3841	Integrated Natural Resources Management I	**8**	EBL3712& EBL3771	EBL3871
EBL3871	Population Ecology	**16**	EBL3771& EBL3712	None
EBL3851	Biogeography	**16**	EBL3712	None
Year 4 Semester 1				
EBL3852	Integrated Natural Resources Management II	**16**	EBL3712& EBL3771	EBL3841
EBL3802	Disturbance & Restoration Ecology	**8**	EBL3712& EBL3771	None
EBL3812	Behavioural Ecology	**16**	EBL3712 or BE3772	None
EBL3822	Entomology	**8**	EBL3722	None
Total Credits		**136**		

E.3.1.6.1. ENVIRONMENTAL BIOLOGY CURRICULUM COURSE DESCRIPTIONS

FIRST YEAR COURSES

BLG3511 INTRODUCTION TO BIOLOGY

Course title:	**INTRODUCTION TO BIOLOGY**
Code:	**BLG3511**
NQF level:	5
Contact hours:	4 lectures / week for one semester and one 3-hour practical session per week and 1hour tutorial per week
Credits:	16
Course assessment:	Continuous assessment **40%** (60 % - minimum of 2 tests and 35% - at least 10 graded practical reports and 5%- at least 2 tutorial assignments) Examination **60%** (1 x 3 hour examination paper)
Prerequisites:	None

Course description: This is an introductory biology course that is designed to allow students to acquire a strong foundation into the biological sciences. The following topics will be covered: Basic techniques in biology such as microscopy, drawing, the scientific method and writing of scientific reports will be covered; Introduction to systems of classification (taxonomy and binomial nomenclature, including the five kingdoms and the three domain system); Organization of life (levels of organization): Molecule, organelle, cell, tissue, organ, organ system, organism, population, community, ecosystem (including the scales in ecology), biosphere; Chemical basis of life: carbohydrates, proteins, nucleic acids, lipids and fats, water; Cell biology: prokaryotic and eukaryotic cells, ultra-structure of plant and animal cells, cytoskeleton, membrane structure and function, cell cycle, cell division; Genes, chromosomes, genomes, Mendelian genetics, extensions to Mendelian genetics, chromosome theory of inheritance; Early theories on evolution, Evolution by natural selection (microevolution vs macroevolution), phylogeny and evolutionary relationships in five kingdoms. (Concepts such as homology and analogy; body symmetry (radial, bilateral), cephalisation, body cavities: diploblastic, triploblastic (acoelomate and coelomate [deuterostomes and protostomes]) will be covered)

BLG3512 DIVERSITY OF LIFE

Course title:	**DIVERSITY OF LIFE**
Code:	**BLG3512**
NQF level:	5
Contact hours:	4 lectures / week for one semester and one 3 hour practical session per week and 1hour tutorial per week
Credits:	16
Course assessment:	Continuous assessment **40%** (60 % - minimum of 2 tests and 35% - at least 10 graded practical reports and 5%- at least 2 tutorial assignments) Examination **60%** (1 x 3 hour examination paper)
Prerequisites:	None

Course description: This course is designed to give students a detailed understanding of the diversity of life. This course gives students the broader appreciation of biodiversity in the different ecological habitats. The following topics will be covered: introduction to systems of classification, taxonomy and binomial nomenclature, including the five kingdom and the three domain system. This course will cover topics of viral, bacterial, fungal, algal and plant diversity. It then considers the characteristics and life cycles of the following important algae and plant groups: chlorophyta, phaeophyta, rhodophyta, chrysophyta, euglenophyta, pyrrophyta, cryptophyta, bryophytes, seedless vascular plants, gymnosperms, and the angiosperms. Protostomate phyla: Nemertea, Mollusca, Anellida, Arthropoda, Nematoda, Rotifera, Lophophorates, Onychophora. Deuterostomate phyla: Echinodermata, Hemichordata and Chordata (Subphyla: Urochordata, Cephalochordata and Vertebrata: Class Myxiniformes, Petromyzontiformes, Placoderms, Chodrichthyes, Actinopterygii, Actinistia, Dipnoi, Amphibia, Reptilia, Aves, Mammalia). Examples from Namibia shall be used where possible and applicable. The course content shall be supplemented with appropriate weekly practical sessions in the laboratory and in the field.The course shall describe diagnostic characteristics of principle taxonomic categories for each phylum. Coverage of each phylum shall follow a phylogenetic approach as well as introduce broad ecological and physiological principles. Various aspects of reproduction and development shall be highlighted.

SECOND YEAR COURSES

BLG3611 ANIMAL FORM AND FUNCTION

Course title:	**ANIMAL FORM AND FUNCTION**
Code:	**BLG3611**
NQF Level:	6
Contact hours:	4 lecture periods per week for one semester and one three hour practical session per week
Credits:	16
Course assessment:	Continuous assessment **40%**: Practicals (at least 10 graded practicals), Theory (3 tests) Examination **60%**: 1x3 hour theory paper
Prerequisites:	**BLG3511** Introduction to Biology and **BLG3512** Diversity of Life

Course description: Introduction: Animal Structural Design and Classification. Protection and the integumentary system. Skeletal systems and movement: Hydrostatic, endo-and exo-skeletons, amoeboid movement, cilia and flagella, muscle structure and physiology. Nutrition and digestion: Feeding on particulate matter, liquids and solid food masses. Digestive systems of different animal groups. Homeostasis: Positive and negative feedback, osmoregulation and thermoregulation. Respiration and gas exchange: Simple diffusion, tracheal systems, book lungs, gills, cutaneous and lungs. The nervous system and sense organs: Nervous systems in different animal groups, neurons, the resting and action potential, the synapse, divisions of the vertebrate nervous system. The Endocrine System. Circulation and Immunity.Reproduction.

EBL3631 INTRODUCTION TO ECOLOGY

Course title:	**INTRODUCTION TO ECOLOGY**
Code:	**EBL3631**
NQF level:	6
Contact hours:	4 lecture periods per week for one semester and one three hour practical session per week
Credits:	16
Course assessment:	Continuous Assessment **(40%**): Practicals 50% (no less than 5 assessed practicals), Theory 50% (3 tests, 1 assignment) Examination **60%**: 1 x 3 hr theory paper
Prerequisites:	**BLG3511** Introduction to Biology, **BLG 3512** Diversity of Life

Course description: Introduction to Ecology and the Biosphere: Definitions, history, scales in ecology, application of ecology, Components of the environment, the levels of organization in Ecology. Conditions and Resources: Environmental conditions, animals and their resources, plants and their resources, Introducing Population Ecology: Characteristics of populations- birth, death, movement, size, age structure, and sex ratios, density, dispersion, demographics, factors and processes influencing, density dependent and independent factors, survivorship curves, life-tables, Life histories . Community Ecology: Patterns in conditions and resources, measuring biodiversity, biomes, biotic interactions, biotic and abiotic influence on community structure. Ecosystem ecology: Primary productivity, flux of matter and trophic structures, food chains and food webs, biogeochemical cycles (hydrological-, carbon-, nitrogen-, and sulphur and phosphorous- cycles) and human influence on them. Conservation Ecology and Biodiversity: Definitions of biodiversity, distribution of the world's biodiversity; the current human caused mass extinction. History, concepts and definitions of Conservation Biology. Aquatic Ecology: The physical properties of water, Stream Ecology, Lake Ecology, Oceans, Coasts, Estuaries.

MBL3631 CELL MOLECULAR BIOLOGY AND GENETICS

Course title:	**CELL MOLECULAR BIOLOGY AND GENETICS**
Code:	**MBL3631**
NQF level:	6
Contact hours:	4 lecture periods per week for one semester and one three hour practical session per week
Credits:	16
Course assessment:	Continuous assessment **40%** (60 % - minimum of 2 tests and 40% - at least 10 graded practical reports) Examination **60%** (1 x 3 hour examination paper)
Prerequisites:	**BLG3511** Introduction to Biology, **BLG3512** Diversity of Life

Course description: Chemical basis of life: water, essential and trace elements, bonds; macromolecules: proteins, carbohydrates, and nucleic acids; lipids and fats; cell structure and function; properties and function of enzymes, and models for binding; cell membrane; cell communication; cell cycle and DNA replication; cellular respiration: glycolysis, transition reaction, Krebs cycle, electron transport chain; and gene expression: transcription and translation.

BLG3621BIOMETRICS I

Course title:	**BIOMETRICS I**
Code:	**BLG3621**
NQA level:	6
Contact hours:	2 lecture periods per week for one semester and one 3-hour practical session every second week for one semester.
Credits:	8
Course assessment:	Continuous assessment **40%:** (Practicals –at least 6 assessed practicals – contribute 40% to CA); Theory (2 tests, 1 assignment – contribute 60% to CA) Examination **60%:** 1x2 hour theory paper
Prerequisites:	**STS3522** Introduction to Statistics
Co-requisite:	**BLG3622** Biometrics II

Course description: Probability and distributions: data types; populations; means and variances; normal distribution; data collection; sampling distributions and sampling designs. Estimation and hypothesis testing: estimation of the population mean; testing hypotheses about the population mean; population variance unknown; comparing samples; pooled estimate of variance. Simple experiments: randomization and replication; completely randomized designs with two treatments; completely randomized designs with several treatments; testing overall variation between treatments.

BLG3612 PLANT FORM AND FUNCTION

Course title:	**PLANT FORM AND FUNCTION**
Code:	**BLG3612**
NQF level:	6
Contact hours:	4 lecture periods per week for one semester and one three hour practical session per week
Credits:	16
Course assessment:	Continuous assessment (**40%**): Theory (not less than 2 tests and 1 assignment); Practicals (not less than 10 marked assignments). Examination (**60%**): 1 x 3 hour theory paper
Prerequisites:	**BLG3511** Introduction to Biology, **BLG3512** Diversity of Life

Course description: Scope and introduction to Pant Biology -Traits common to all plants: Apical meristems, Alternation of generations, dependent multicellular embryo, sporangia and gametangia. Review of major groups of plants: survey through the 10 extant plant phyla - Hepatophyta, Anthocerophyta, Bryophyta, Lycophyta, Pterophyta, Cycadophyta, Gingkophyta, Gnetophyta, Coniferophyta and Magnoliophyta. Topics will emphasize the morphological adaptations of plants, the genetic properties of plant populations, plant reproduction and mating system variation, a survey of biotic and abiotic ecological interactions important to flowering plants. Plant Structure, Growth and development, Functional Plant -Microbe Associations, Stem Form and Function, Roots Form and Function, Leaves Form and Function, The flowering Plant and Animal Coevolution, Plant Adaptation to various environments. Laboratory work will include a survey of flowering plant taxonomy and plant forms and functions. Laboratory projects will explore various plant structures in selected groups, and discuss functional relationships, as well as identifying adaptive features of plant form and function.

EBL3632 ECOLOGICAL FIELD TECHNIQUES

Course title:	**ECOLOGICAL FIELD TECHNIQUES**
Code:	**EBL3632**
NQF Level:	6
Contact hours:	4 lecture periods per week for one semester, 3 hours practical per week for one semester
Credits:	16
Course assessment:	Continuous assessment **40%** (60 % - minimum of 2 tests and 40% - at least 10 graded practical reports) Examination **60%** (1 x 3 hour examination paper)
Pre-requisites:	**BLG3511** Introduction to Biology, **BLG3512** Diversity of Life

Course description: Formulation of scientific questions and hypotheses in the field; Quality assurance criteria during field work: replication, blanks, repetitions; Safety during field sampling; Ecological Field Sampling: Considerations in field sampling (objectives of sampling, type and behaviour of organism, habitat considerations, equipment requirements, selection of appropriate method, sampling design and strategy, random sampling, sample size, data recording and storage); Basic Ecological Measurements: Density, frequency, coverage and biomass; Methods of sampling terrestrial vascular plants, surveying fungi, lichens and mosses (Basic vegetation measures, Plot-based and plotless-based techniques); methods of sampling aquatic macrophytes and algae; methods of sampling invertebrates in the field; methods of inventorying small mammals; methods of surveying large mammals; methods of sampling reptiles; methods of sampling birds and bats; methods of sampling fish and other aquatic animals. All the discussions on methods must include their applicability, advantages and disadvantages of in every case. Preserving organisms for natural history collections (killing jars and their uses, herbarium specimens, 'spirit' collections, dry mounts, various agents of preservation and their advantages and disadvantages); simple dichotomous keys and their uses (parallel keys, indented keys, flow-chart keys only); methods of assessing abiotic variables, data analysis methods (include basic statistics).

MBL3632 INTRODUCTION TO MICROBIOLOGY

Course title:	**INTRODUCTION TO MICROBIOLOGY**
Code:	**MBL3632**
NQA level:	6
Contact hours:	4 lecture periods per week for one semester and one 3-hour practical session per week for one semester.
Credits:	16
Course assessment:	Continuous assessment **40%:** Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment) Examination **60%:** 1x3 hour theory paper
Prerequisites:	**BLG3511** Introduction to Biology, **BLG3512** Diversity of Life.

Course description: The course includes principles of microbiology, importance of microorganisms, microorganisms as cells, microorganisms and their natural environments, impacts of microorganisms on humans, and pathways of discovery in microbiology: historical roots of microbiology, Pasteur and the defeat of spontaneous generation, Koch postulates, infectious disease, pure culture microbiology. Microbial diversity and the rise of general microbiology. The modern era of microbiology. It will also give an overview of microbial life, cell structure and evolutionary history, physiological diversity of microorganisms, prokaryotic diversity, and eukaryotic microorganisms. Other topics are microscopy and cell morphology, microbial cell membranes and cell walls, surface structures and inclusions, endospores, microbial motility and chemotaxis, staining techniques, microbial nutrition, culture media, laboratory culture of microorganisms, enrichment and isolation, isolation of pure cultures, bacterial cell division, growth of bacterial populations, measuring microbial growth, environmental effects on microbial growth, control of microbial growth, microbial evolution and systematics, Eubacteria, Achaea, eukaryotic microorganisms, viruses, bacteriophages, prions, diversity of microbial metabolism, microbial ecology, and methods in microbial ecology.

BLG3622 Biometrics II

Course title:	**BIOMETRICS II**
Code:	**BLG3622**
NQA level:	6
Contact hours:	2 lecture periods/week for one semester and one 3-hour practical session every second week for one semester.
Credits:	8
Course assessment:	Continuous assessment **40%:** (Practicals –at least 6– contribute 40% to CA); Theory (2 tests, 1 assignment – contribute 60% to CA) Examination **60%:** 1x2 hour theory paper
Prerequisites:	**STS3522** Introduction to Statistics
Co-requisite:	**BLG3621** Biometrics I

Course description: Control of the random variation: local control of variation; blocking; randomized block designs; meaning of error mean square; assumptions behind analysis; significance tests; comparison of two samples; one-way ANOVA; factorial experiments; split plots; Latin square designs; Studying linear relationships: linear regression; correlation; inferences; analysis of covariance. More complex relationships: multiple regressions. Analysis of proportions; non-parametric statistics; choosing a good experimental design; computers and statistical analysis of data; practice and presentation of data and results.

THIRD YEAR COURSES

EBL3751 AQUATIC ECOLOGY

Course title:	**AQUATIC ECOLOGY**
Code:	**EBL3751**
NQF Level:	7
Contact hours:	4 lectures / week for one semester and one 3-hour practical session every second week for one semester.
Credits:	16
Course assessment:	Continuous assessment **40%:** Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment) Examination **60%:** 1x3 hour theory paper
Prerequisites:	**EBL3631** Introduction to Ecology

Course description: General characteristics of water as a medium of life and how it differs from air as a medium of life in terrestrial ecosystems.Freshwater EcologyEcology of lentic systems (lakes, dams and ponds): Thermal stratification, seasonal lake turnover (destratification) and its effects on productivity; Energy flow and food webs in lentic systems; Eutrophication and harmful algal blooms. Ecology of lotic systems (rivers and streams): Distinguishing characteristics of rivers; the river continuum concept; Ephemeral river dynamics; Floodplain dynamics; Energy flow and food webs in lotic systems; Freshwater wetland systems of Namibia. Marine EcologyPhysical and chemical oceanography: Extent and depth of the oceans, ocean currents, Physical conditions (temperature, pressure, illumination, El Nino events); chemical conditions (gases, nutrients, pH and alkalinity); Ocean circulation (great conveyor system, physics of waves, tides and upwelling); upwelling. Productivity of oceans: Nutrients, upwelling, plankton, Harmful algal blooms, energy flow and food webs in the pelagic environment.Intertidal zone ecology: Rocky shores and sandy shores – physical conditions and adaptations of organisms, zonation within the intertidal zoneAquatic biogeochemistry and ecology: Sulfide events (eruptions).

EBL3752 ECOPHYSIOLOGY

Course title:	**ECOPHYSIOLOGY**
Code:	**EBL3752**
NQF level:	7
Contact hours:	4 lecture periods per week for one semester, 3 hour practicals per week for one semester
Credits:	16
Course assessment:	Continuous assessment **40%**: Practicals (at least 10 assessed practicals), Theory (3 tests) Examination **60%**: 1x3 hour theory paper
Prerequisites:	**BLG3611**, Animal Form and Function**, BLG3612** Plant Form and Function

Course description: Introduction: What is Ecophysiology? Temperature: thermoregulation and energy (heat) budgets of animals; Temperature stress in plants: cryobiology, hardening and heat shock, chilling, freezing, and high temperature stress. Water relations: Physics of water movement; Animal water balance, nitrogen excretion, and excretion mechanisms; Plant water stress, dehydration, and drought injury, drought avoidance, drought tolerance, and drought resistance, excess water or flooding stress. Metabolism: Exercise and scaling; hypometabolism; measuring field metabolic rates. Light: Responses to light, photodetection, photosynthesis and the photoperiod. Nutrition and energy: Nutrient acquisition, use and loss in plants and animals. Plant and animal dormancy and physiology of aestivation. Respiration: Factors influencing respiration rates and blood chemistry; adaptations to hypoxia. Adaptations to low and high pressure situations. Plant response/adaptation to fire, plant-animal interactions (herbivory) - secondary compounds in plants; plant growth and carbon partitioning -resource allocation in plants under different conditions (underground vs aboveground biomass); interactions of internal and external factors in determining photosynthetic efficiency and seasonal control of growth and development; reproductive ecology – An overview of the seed germination and ecology, plant energy budgets - tradeoffs between seed mass(size), dormancy, dispersal ability and seedling establishment. Environmental Conditions that pose potential toxicity: Adaptations/responses and acclimation to increased CO_2, hyper salinity, UV radiation and ozone; Plant adaptation and acclimation to adverse soil conditions: deficiencies and toxicities acidity, alkalinity, and heavy metals; Plants-soil interactions-rhizosphere processes; Endocrine disrupting chemicals and its effects in animals.

EBL3741 ECOLOGICAL SYSTEMS AND CLIMATE CHANGE

Course title:	**ECOLOGICAL SYSTEMS AND CLIMATE CHANGE**
Code:	**EBL3741**
NQF Level:	7
Contact hours:	2 lecture periods per/ week; 3 hours practical every second week for one semester
Credits:	8
Course assessment:	Continuous assessment **40%**: Practicals (at least 6 assessed practicals), Theory (2 tests, 1 assignment) Examination **60%:** 1x 2 hours theory paper
Pre-requisites:	**EBL3631** Introduction to Ecology
Co-requisite:	**GLE3721:** Environmental Geochemistry

Course description: This course will expose students to the following topics:
Climate change science: the main elements of climate change, greenhouse gases, the sun, anthropogenic factors and the greenhouse effect, previous changes (warming and ice age,). Methods to measure climate change, sources of data, how the data is obtained and different models –global, downscaling, uncertainties. Causes of climate change -greenhouse gas emissions, nitrogen deposition and pollution, land-use change).Impacts of climate change at global, regional and national level; e.g. sea level rise, rise in global temperature, floods, drought, extreme events.The course will explore specific impacts of climate change on socio-economic sectors and ecological systems how organisms and ecosystems affected. How 'climate change' influence primary productivity, nutrient cycling, water relations and vegetation-climate feedbacks. The course will also discuss vulnerability to impacts of climate change. Linkages between climate change and medium (e.g. Millennium Development Goals and National Development goals) to long-term (e.g. Vision 2030) development goals.Climate change, poverty, gender and environmental sustainability. Adaptation and mitigation of climate change. The role of indigenous /Traditional knowledge systems in climate change adaptation and mitigation. Biological responses to CC will be examined in the context of aquatic and terrestrial ecosystems . Legal and policy frameworks on climate change. The United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, Post-Kyoto. The Clean Development Mechanism; carbon trading; tradable permit system, integrated framework of climate change.carbon sequestration and dynamic global vegetation models. As far as possible, and where applicable, relevant and appropriate discussion points and examples from Namibia will be used on each of the above e.g. vulnerability of Namibia to impacts of climate change, adaptation (food security and sustainable resource base, sustainable water resources, human health and well-being, infrastructure) and mitigation (sustainable energy and low carbon development, transport) of climate change in Namibia. Climate change cross-cutting issues in Namibia: capacity building, training and institutional strengthening, research and information, public awareness, participation and access to climate change information, disaster reduction and risk management, financial resource mobilization, international cooperation and networking, technology development and transfer, legislative development. National policy on climate change for Namibia. Namibia climate change strategy and action Plan. Climate change–related projects such as the Country partnership Program, Africa Adaptation project etc will be discussed.

EBL3712 ECOSYSTEM ECOLOGY

Course title:	**ECOSYSTEM ECOLOGY**
Code:	**EBL3712**
NQF level:	7
Contact hours:	4 hours lectures / week, 3 hrs practicals per week for one semester
Credits:	16
Course assessment:	Continuous assessment **40%**: Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment) Examination **60%**: (1x3 hours theory paper)
Prerequisites:	**EBL3631** Introduction to Ecology

Course description: Basic components of ecological systems, essential processes of ecological systems: Photosynthesis and decomposition. Nature of ecosystem energetics.Primary production; environmental factors facilitating and / or limiting primary production. Secondary production; environmental factors facilitating and / or limiting, food chains and food webs; trophic levels and ecological pyramids, Food chains and poisons in the environment, models of energy flow in ecosystems. What is a community?Physical (vertical and horizontal) structure, biological structure (species dominance, species diversity); species diversity hypotheses, species abundance, edge communities, community population interactions, community patterns in space and time. Theory of island biogeography, habitat fragmentation, habitat corridors, applications of island biogeography theory to design of protected areas. ecological disturbance?Characteristics of ecological disturbance (intensity, frequency and scale), Causes of disturbance, impacts of disturbance on nutrient cycling, Responses of animals to disturbance, disturbance and community stability. What is community succession?Process of ecological community succession, Types of succession; primary and secondary succession, Causes of succession; models of succession, climax succession state; climax community, theories of climax succession, fluctuations in climax communities, attributes of succession during succession, time and direction in succession, changes in ecosystem attributes, time and direction of succession, succession and animal life, degradative succession. Definition and classification of biomes.Desert biome, Tropical savanna biome, Tropical rain forest biome, grassland biome. For each biome, shall cover: geographic location, climate, soils, life forms, and human activities. Classification of biomes of Namibia. Desert biome, savanna biome, woodland biome, Karroo biome, Coastal and marine biome, wetland biome, land use practices in terrestrial and aquatic biomes of Namibia. What are arid environments? Causes and classification of arid ecosystems, characteristics of arid ecosystems; water (surface and ground), floods, Humidity, temperature, wind and wind erosion, soils, dust & dust storms, adaptations of organisms to arid environments. What is desertification? Causes of desertification (proximate and ultimate causes), manifestations of desertification, action to combat desertification, What is deforestation? Causes of deforestation (proximate and ultimate causes), Effects of deforestation; deforestation in Namibia, possible solutions to deforestation.

BLG3702 RESEARCH METHODOLOGY

Course title:	**RESEARCH METHODOLOGY**
Code:	**BLG3702**
NQF level:	7
Contact hours:	2 lecture session per week, 3 hour practical every other week for one semester
Credits:	8
Course assessment:	Continuous assessment **100%** (5 assessed assignments, 1 test). Students should have prepared and present their research proposal by for their research project at the end of this course.
Prerequisites:	**BLG3621** Biometrics I, **BLG3622** Biometrics II

Course description: Ethics of research. The scientific method: logic and the scientific, natural observations, asking questions and formulation of hypothesis, predictions. Types of hypotheses; null, alternative, research. Biological variation, populations and sampling.Statistical significance.Experimental (research study /project) design.Data collection & keeping / documenting research data and other records. Scientific writing, Plagiarism, Finding and using literature references, Citation of references. Writing a literature review.Writing a research proposal.Report writing. Presenting results in an oral presentation. Presenting results as posters.

EBL3771 CONSERVATION BIOLOGY AND BIODIVERSITY

Course title:	**CONSERVATION BIOLOGY AND BIODIVERSITY**
Code:	**EBL3771**
NQF level:	7
Contact hours:	4 lecture periods per week for one semester, 3 hours practical per week for one semester
Credits:	16
Course assessment:	Continuous Assessment **40%**: Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment) Examination **60%**: 1 x 3 hr theory paper
Prerequisites:	**EBL3631** Introduction to Ecology

Course description: Students will study in depth: Introduction: History and definition of Conservation Biology and Biodiversity. Biodiveristy: Global patterns, distribution and measurement of biodiversity with special emphasis on Namibian biodiversity; Biodiversity inventories; rapid biodiversity assessment. Environmental ethics. Ecological Economics: valuation of biodiversity with emphasis on the direct use value, indirect use value, option value, and existence value. Threats to Biological Diversity: Extinction with special emphasis on the causes of extinction (Habitat destruction, habitat fragmentation, habitat degradation and pollution, global climate change, overexploitation, invasive and alien species, and disease) as well as species vulnerability to extinction. Island Biogeography and extinction rates. Conservation at the population and species level: Species categories (keystone, indicator, flagship, umbrella and economically important species), Essential concepts and problems of small populations. Applied population biology: Studying populations, population viability analysis, metapopulations, establishing new populations, *Ex Situ* conservation, Conserving Biological Communities: Prioritising, establishing and classifying protected areas, Reserve design and conservation networks, SLOSS model, managing protected areas. Habitat restoration.Biodiversity conservation agreements.

EBL3721 BIOSYSTEMATICS I

Course title:	**BIOSYSTEMATICS I**
Code:	**EBL3721**
NQF level:	7
Contact hours:	2 lecture periods / week for one semester and 1 practical every second week for one semester
Credits:	8
Course assessment:	Continuous Assessment: Continuous assessment 40%: Practicals 35% (5 or more assessed practical work), Theory 45% (3 tests, 1 assignment), Specimen Collecting project (15%); seminar presentations (5%). Examination 60%: (1 x 2 hours theory paper)

Prerequisites: BLG3612 Plant Form and Function, **BLG 3611** Animal Form and Function

Course description: This course will lay the foundation of biosystematics as follows:**Introduction to biological systematics: Definitions, Importance, Roles and Values**Methods of identification, Taxonomic characters; Taxonomic keys: types (their merits and demerits), use and construction of. Plant Morphology: General Structure Terms, those used for a specific structure/organ; terminology related to vegetative and reproductive structures Angiosperms plant familiesTaxonomic collections (**Specimens, collections, curation** and preservation of specimens, Herbarium collections and their management, The value of Natural History Collections); techniques for collecting and preserving plants; **Plant Collecting Project** (Students will be required to carry out a compulsory mini-project on the collection and preservation of plant specimens from a selection of important plant families.**Nomenclature & Classification -** the data and procedures employed in the practical discovery, naming and description of previously undescribed species. -Principles of biological nomenclature/naming, provisions of International Codes of Botanical and Zoological Nomenclature-their operative principles, interpretation and application of important rules, formation of scientific names of various taxa; Process of typication and different Zoological and Botanical types; PhyloCode**Plant Families**– a survey of plant families with the focus on important taxonomic /distinguishing characters. Common and important families will be selected to represent various groups -Characteristics of important families in the region. flowering plant systematics and diversity**.**Current issues in biosystematics: seminar discussions on current topics in biosystematics (including nomenclature, natural history collections).Each student is required to conduct a theory seminar in which he/she explores a topic of choice from selected list of current topics in Biosystematics in the published literature e.g cases of name change, PhyloCode.

EBL3722 BIOSYSTEMATICS II

Course title: **BIOSYSTEMATICS II**
Code: **EBL3722**
NQF Level: 7
Contact hours: 2 lecture periods / week for one semester and 1 practical every second week for one semester
Credits: 8
Course assessment: Continuous Assessment: Continuous assessment **40%**: Practicals 35% (5 or more assessed practical work), Theory 45% (3 tests, 1 assignment), Specimen Collecting project (15%); seminar presentations (5%). Examination **60%**: (1 x 2 hours theory paper)
Pre-requisites: **BLG3612** Plant Form and Function; **BLG 3611**Animal Form and Function
Course description: This course will deal with Classification and Phylogeny in animals
Introduction to Phylogeny and systematics: Definition and basic concepts; The tree of LifeTheories of biological classification: various methods of classification systems from the earliest days to modern techniques, especially highlighting cladistics. History and Development (traditional (artificial) vs natural classifications; phenetic classification, Phylogenetic classification, Cladistics) Cladistics: Cladograms -Monophyl, Paraphyly and Polyphyl; sorting Homology and Analogy.Phylogenetic relationships within and amongst taxa: **Sources of data** (Fossil, morphological, molecular) and analytical methods (parsimony, likelihood, Bayesian) employed in phylogeography and phylogeny reconstruction;Molecular systematics reveals new insights Animal phylogeny/classification and diversitya survey of animal taxa with the focus on important taxonomic /distinguishing characters and identification terminology. Common and important taxa will be selected to represent various groups Species and speciation: Species concepts – species category, sub-species and other infra specific categories Taxonomic collections (**Specimens, collections, curation** and preservation of specimens, Museum collections and theirmanagement, The value of Natural History Collections); techniques for collecting and preserving animals; **Animal Collecting Project** (Students will be required to carry out a compulsory mini-project on the collection and preservation of selected animal specimens.Current issues in biosystematics (including natural history collections, classification and phylogeny, rankless classification.

FOURTH YEAR COURSES

EBL3800 FIELD ECOLOGY

Course title: **FIELD ECOLOGY**
Code: **EBL3800**
NQF level: 8
Contact hours: 4 weeks field trip (2 weeks in each semester)
Credits: 16
Course assessment: Continuous assessment: **100%** (field report)
Pre-Requisites: **EBL3711** Aquatic Ecology, **EBL3771** Conservation Biology and Biodiversity, **EBL3712** Ecosystem Ecology, **EBL3752** Ecophysiology
Co-requisites: **EBL3841** Integrated Natural Resources Management I **EBL3851** Biogeography, **EBL3812** Behavioural Ecology and **EBL3852** Integrated Natural Resources Management II;
Course description: This course is designed to provide opportunity for students to acquire more field ecological, computational and analytical and thinking skills to undertake independent research designed to address relevant / specific practical problems. Students will be expected to practically apply knowledge that they have acquired in various courses they will have completed. This course is fully field-based. It will be conducted in various localities, to cover diverse ecosystems in Namibia. During the field course, students will be required to undertake mini-research projects that will require application of various data collection techniques, data analysis, interpretation, discussion and report writing. The mini projects will emphasize application of various ecological techniques, methods and procedures. The field course will be jointly offered by diverse expertise / lecturers / collaborating partners to ensure that multidisciplinary skills are acquired in an integrated manner. During the field course, 75% of the time will be dedicated to activities to enhance acquisition of practical skills. The course will be implemented through two field trips that will be undertaken in the first and second semester. Topics include: Investigating/assessing ecological complexity at different levels of biological organization (from cells to the biosphere), ecosystems approach to addressing ecological and environmental challenges, collecting, analysing and reporting ecological data, communicating scientific information from research, problem-solving procedures to analyse practical ecological and environmental problems. Application of different biotic sampling techniques / methods and application of different methods used to collect abiotic data. The specific skills to be acquired by students will vary from year to year and also depend on the chosen locality and expertise / lecturers that will be available and in charge of each field visit.

BLG3810 RESEARCH PROJECT

Course title: **RESEARCH PROJECT**
Code: **BLG3810**
NQF level: 8
Contact hours: Research project for one year
Credits: 32
Course assessment: Continuous assessment: 100% (Oral presentation of research proposal – 10%; written research proposal – 20%, oral presentation of results – 20%, written research report - 50%)
Prerequisites: **BLG3702** Research Methodology
Course description: This course is designed to develop the research skills of students through the completion of a research project on an approved topic in the context of the major. Students will be expected to develop a research proposal with the guidance of the supervisor, present this proposal both orally and in writing, collect and analyze data using appropriate statistical tests, present the findings both orally and in the form of a research report; the report should be between 20 and 30 pages (Times New Roman 12 pt, 1.5 line spacing) and include a statement of the research problem, literature review including recent journal resources, objectives and hypotheses, methodology, results & data analysis, conclusion.

EBL3841INTEGRATED NATURAL RESOURCES MANAGEMENT I

Course title: **INTEGRATED NATURAL RESOURCES MANAGEMENT I**
Code: **EBL3841**
NQF level: 8
Contact hours: 2 lecture periods per week, 3 hour practical every second week for one semester
Credits: 8
Course assessment: Continuous assessment **40%:** Practicals (at least 5 assessed practicals), Theory (at least 2 tests, 1 assignment); Examination **60%:** (1 x 2 hrs theory paper)
Pre-requisites: **EBL3712** Ecosystem Ecology**, EBL3771** Conservation Biology and Biodiversity
Co-requisite: **EBL 3871 Population Ecology,**

Course description: Introduction and Overview (Definitions of management, integrated management, sustainable management, natural resources; Objectives of natural resources management, Concept of adaptive management and adaptive decision-making in natural resources management); Classification of natural resources (stock, flow, renewable, non-renewable, perpetual, exhaustible, non-exhaustible); Measures of stock resource availability (resource base, proven reserves, conditional, reserves, hypothetical resources, speculative resources, ultimately recoverable resources); Measures of flow resource availability (maximum resource potential, sustainable capacity, absorptive capacity, carrying capacity); Causes and consequences of resource scarcity; Indigenous knowledge systems (IKS) in natural resource management (definitions, importance, examples); Community based natural resource management (CBNRM) initiatives in southern Africa (Communal conservancies in Namibia, CAMPFIRE in Zimbabwe, etc.); Human-wildlife conflict (HWC) (causes, consequences, management of the problem).

EBL3871 POPULATION ECOLOGY

Course title: **POPULATION ECOLOGY**
Code: **EBL3871**
NQF Level: 8
Contact hours: 4 lecture periods per week, 3 hour practical per week for one semester
Credits: 16
Course assessment: Continuous assessment **40%**: Practicals 50% (at least 5 assessed practicals), Theory 50% (2 tests, 1 assignment) Examination **60%:** (1 x 3 hrs theory paper)
Pre-requisites: **EBL3712** Ecosystem Ecology**, EBL3771** Conservation Biology and Biodiversity

Course description: This course provides students with and in-depth knowledge on Populations Ecology. The following topics will be dealt with: Population growth (density-independent growth (exponential, geometric), density-dependent growth (logistic), population fluctuations and cycles and their causes and consequences); Population regulation (mechanisms of population regulation (intra-specific competition, dispersal, social interactions, etc.), key factor analysis); Life history strategies/characteristics (allocation of energy and reproductive effort, importance of body size on population processes, diapause, dormancy, migration and dispersal, r- and k-selection); Inter-specific competition (ecological niche and niche overlap, competitive exclusion principle, resource partitioning, character displacement, Lotka-Volterra equation); Predation (classification of predators, diet width, diet composition and diet preference, foraging theory and models of diet selection, classical predator-prey systems, plant-herbivore interactions, functional response, numerical response, cannibalism and its evolutionary significance); Mutualism (definitions and importance, types and examples of mutualism); Parasitism (classes of parasites and hosts, parasite-host distributions and meta-population dynamics, evolutionary aspects of parasitism, social parasitism); Population genetics (recap Mandelian genetics, genetic variation, natural selection, inbreeding, genetic drift); Aspects of Applied Population Ecology (Introduction to population dynamics modeling (conceptual, simulation), Population Viability analysis).

EBL3852 INTEGRATED NATURAL RESOURCES MANAGEMENT II

Course title: **INTEGRATED NATURAL RESOURCES MANAGEMENT II**
Code: **EBL3852**
NQF Level: 8
Contact hours: 4 lecture periods per week, 3 hour practical per week for one semester
Credits: 16
Course assessment: Continuous assessment **40%:** Practicals (at least 10 assessed practicals), Theory (at least 2 tests, 1 assignment, other forms of assessment) Examination **60%:** (1 x 3 hrs theory paper)
Pre-requisites: **EBL3712** Ecosystem Ecology**, EBL3771** Conservation Biology and Biodiversity
Co-requisite: **EBL 3841** Integrated Natural Resources management I

Course description: This course prepares students for careers in management of natural resources. The following topics will be covered: Wildlife/Game management in Parks and Ranches (management for tourism and harvest, manipulation of animal numbers, concept of maximum sustained yield (MSY) in wildlife management, International and national conventions/legislation/regulations related to wildlife management and trade); Management of forest/woodland resources (definitions, types of forest management (by the State, by local communities, co-management, multi-stakeholder management, non-timber forest products); Fisheries resources management (Concept of a stock, multi-species fishery management, MSY concept in fisheries management, integrated fisheries management); Integrated water resources management (IWRM) (evolution of water management, Principles of IWRM, National and International conventions/regulations/laws/policies on IWRM); Integrated coastal zone management (ICZM) (the need for ICZM, Principles of ICZM; National and International conventions/regulations/laws/policies on ICZM); Environmental management (Principles of environmental management, National and International conventions/treaties/policies on environmental management, Environmental management systems (ISO 14000 series standards); Integrated Environmental Management (Integrated Environmental Management Systems (IMS), Principles of IMS, Environmental impact assessment (EIA), Environmental Audits, Project management); Waste management; Basics of Natural resource economics (economic systems, cost-benefit analysis, placing money on non-market goods, valuation approaches/methods); Basics of Ecological Economics (definitions, outline of some current problems in society, economics and ecology, fundamental principles of ecological economics, introduction to
modeling ecological–economic systems).

EBL3851 BIOGEOGRAPHY

Course title: **BIOGEOGRAPHY**
Code: **EBL3851**
NQF level: 8
Contact hours: 4 lecture periods per week, 3 hour practical per week for one semester
Credits: 16
Course assessment: Continuous Assessment 40% (at least 10 assessed practicals, 1 assignment, 2 tests) Exam 60% (1x3 hours theory paper)
Pre-requisites: **EBL3712** Ecosystem Ecology

Course description: This course will introduce students to the science of BIOGEOGRAPHY; a study of the distribution of past and present life on the earth. This course will cover the distribution patterns of wild plants and animals over the earth's surface. It will describe factors that determine temporal (in time) and spatial (in space) patterns of biological diversity (biodiversity). Historical changes in distribution of plants and animals will be examined using data and concepts from different disciplines such as geology, ecology, evolutionary biology and physical geography. Important biogeographic processes such as speciation, dispersal and extinction will be covered. The course will further describe past changes in the physical geography of the earth in an attempt to understand the role of such changes to the present and past distribution of plants and animals. As far as possible, and where applicable, relevant and appropriate examples from Namibia will be used. Biogeography: definition, relationship with other sciences, philosophy and basic principals, brief history, applications of biogeography, Limits of species distributions: ecological niche, physical limiting factors, limitation by biotic interactions, adaptation and gene flow. Historical biogeography: Past changes in the physical geography of the earth: Geologic time scale, continental drift model, continents of the Paleozoic and early Mesozoic and early past changes in the physical geography of the earth: break-up of Gondwanaland. Speciation and extinctions: speciation, adaptive radiation, extinction, species selection. Dispersal: definition, mechanisms of biotic movement, nature of barriers to biotic movement, establishing a colony, dispersal routes. Invasive species will be used as case studies to illustrate various aspects of dispersal. Endemism, Provincialism & Disjunction: endemism, cosmopolitanism, types of endemics; provincialism – terrestrial biogeographic regions, biogeographic lines, classifying islands, aquatic regions and provinces, quantifying similarity among biota; Disjunction- definition & causes. Biogeographic distribution patterns of terrestrial animals: abilities of land creatures to cross water barriers amphibians, reptiles, mammals. Biogeographic distribution patterns of flying animals: bird, bats and insects. Biogeographic distribution patterns of plants: factors limiting growth and reproductive success of plants, regional endemism and patterns of speciation in plants, distribution patterns of non-vascular plants. Latitudinal taxonomic diversity gradients; latitudinal gradients in species.diversity, factors that may account for geographic patterns of species diversity: historical perturbations, productivity, harshness, climatic stability, habitat heterogeneity, competition, predation, mutualism.

EBL3802 DISTURBANCE AND RESTORATION ECOLOGY

Course title: **DISTURBANCE AND RESTORATION ECOLOGY**
Code: **EBL3802**
NQF Level: 8
Contact hours: 2 lecture periods per week, 3-hour practical every second week for one semester
Credits: 8**Course assessment:** Continuous assessment **40%**: (practicals at least 5 assessed practicals); theory (2 tests, 1 assignment)
Examination **60%** (1 x 2-hour theory paper)
Pre-requisites: **EBL3712** Ecosystem Ecology and **EBL3771** Conservation Biology and Biodiversity

Course description: The world today is grappling with problems of degradation of habitats due to various factors. Such factors are usually referred to as 'disturbance factors' since they make these habitats less suitable for the original species to occupy. Such habitats have to be restored, somewhat, in order to conserve biological diversity. This course is designed to equip students with the knowledge about various disturbance factors and their impacts on the quality of habitats. The course also presents various approaches of restoring degraded/disturbed landscapes. Disturbance ecology: Introduction (definitions, importance of disturbance, natural and anthropogenic disturbance, short-term and long-term aspects of disturbance, temporal and spatial aspects, reversible and non-reversible disturbance, disturbance regimes); resilience and stability in the face of disturbance; susceptibility to disturbance; types of disturbances and their impacts on ecosystem structure, function and productivity (include case examples to demonstrate impacts of fire, pollution, deforestation, unsustainable land management practices, over-exploitation, climate change, volcanoes, alien species, etc on the provision of goods and services by various ecosystems); interactive/synergistic impacts of disturbance factors; responses to disturbance from the organism level upwards the hierarchy, disturbance and biodiversity (include the intermediate disturbance hypothesis); modeling as a tool in disturbance ecology.

Restoration Ecology: Introduction (definitions, the need and importance of restoration); indicators of ecosystem degradation; principles of ecological restoration; planning for ecological restoration (various ecosystems); ecological restoration in practice (include case examples on various ecosystems); natural restoration (recap on the concept of succession); involvement of local communities in restoration work (case examples); Bio-monitoring and evaluation of the restoration process; challenges and opportunities for improving degraded landscapes.

EBL3812 BEHAVIOURAL ECOLOGY

Course title: **BEHAVIOURAL ECOLOGY**
Code: **EBL3812**
NQF level: 8
Contact hours: 4 lecture periods per week, 3 hour practical per week for one semester
Credits: 16
Course assessment: Continuous Assessment 40%: (at least 10 assessed practicals, 2 tests)
Examination 60%: (1x 3 hours theory paper)
Pre-requisites: **EBL3712** Ecosystem Ecology or only **EBE3772** for education students

Course description: This course will introduce students to the role of behavior in understanding ecology of organisms. Special emphasis will be given to the genetic basis of behavior, how behavior evolved (phylogeny) as well as how it develops in organisms (ontogeny). These will provide a foundation to understand learned and innate behavior and how behavioral ecology is instrumental in applied ecology disciplines such as conservation biology. Any student who does not take part in the field course in EBL3800 Field Ecology II will NOT be allowed to sit the examination. Introduction: definition of behavior, nervous system and behavior, simple (reflexes) and complex behavior. Development (Ontogeny) of behaviour: nature and nurture, instinct and learning in their biological setting, maturation-development involving growth, hormones and early development, play, imprinting and early experience. Evolution (Phylogeny) of behaviour: natural selection and behaviour, genetic basis of behaviour, the adaptiveness of behaviour, ritualisation. Diversity of behaviour: Innate behaviour, innate releasing mechanisms, fixed action patterns. Learned behaviour: habituation, conditioned reflex Type 1, trial & error learning, latent learning, insight learning. Communication: definition, evolution and use of signals in communication, information content of signals e.g. honey bees, manipulation in communication, cost, honesty/deceit & handicaps. Sex and sexual selection, advantages of sex (why two sexes), selection on males and females, Mate choice (male/female competition and female/male choice), Intra-and inter-sexual selection, sperm competition and mate guarding. Feeding and anti-predator behaviour: Feeding behaviour, diversity of prey capture techniques (prey detection and capture), optimal foraging behaviour, costs & benefits, optimality models, constraints in foraging efficiency; Anti-predator behaviour: detection of predators, chemical defenses, warning colouration, mimicry, alarm signals, improved vigilance, selfish herd effect. Dilution effect; Social organisation; group living (advantages), types of mating systems (e.g. polyandry, polygyny, monogamy, lek), social dominance, cooperation, aggression, altruism, parental care, territoriality , primate social organisation, insect social organisation.

EBL3822 ENTOMOLOGY

Course title:	**ENTOMOLOGY**
Code:	**EBL3822**
NQF level:	8
Contact hours:	2 lecture periods / week and 1x3hour practical sessions every second week for one semester
Credits:	8
Course assessment:	Continuous assessment: **40%;** practicals (at least 5 graded practicals), at least 2 tests, and 10% of CA for insect collection/identification project. Examination **60%:** 1x2 hour theory paper
Prerequisites:	**EBL3722** Biosystematics II

Course description: Introduction to entomology; Why study entomology. Structure: segment morphology; internal and external insect structures; Physiology: insect growth, development and physiology; Insect senses and behavior (including communication); pheromones.Insect diversity: Common insect Orders and their representatives; Orthoptera; Isoptera Hemiptera; Neuroptera; Coleoptera; Diptera; Lepidoptera; Hymenoptera. Pests and beneficial insects, key pests in Namibia, secondary pests; insects as vectors of disease; insect vector-parasite relations; secondary plant metabolites and plant-insect relationships; economic damage.Pest management, Crop protection methods; Integrated Insect Pest Management (IIPM).

BLG3880 RESEARCH METHODOLOGY AND PROJECT

Course title:	**RESEARCH METHODOLOGY AND PROJECT**
Code:	**BLG3880**
NQF level:	8
Contact hours:	Research project for one year
Credits:	38
Course assessment:	Continuous assessment: 100% (Oral presentation of research proposal – 10%; written research proposal – 20%, oral presentation of results – 20%, written research report - 50%).
Prerequisites:	**BLG3702** Research Methodology

Module Description: This module is designed to develop the research skills of students through the completion of a research project on an approved topic in the field of Environmental Biology / Microbiology. Students will be expected to develop a research proposal with the guidance of the supervisor, present this proposal both orally and in writing, collect and analyze data using appropriate statistical tests, present the findings both orally and in the form of a research report; the report should be between 20 and 30 pages (Times New Roman 12 pt, 1.5 line spacing) and include a statement of the research problem, literature review including recent journal resources, objectives and hypotheses, methodology, results & data analysis, conclusion, and recommendations. Students will undergo a two weeks review of the following aspects of research methods to assist them in the drafting, conducting and write up of their Honors Research project reports:- Ethics of research; the Scientific method including hypotheses; sampling techniques and methods; scientific writing (literature review, research proposal) and presentation of scientific findings. The review will take the form.

E.3.1.6.1.1. DEPARTMENT OF BIOLOGICAL SCIENCES MODULE EQUIVALENTS

COURSE EQUIVALENTS

YEAR	SEMESTER	OLD COURSE	EQUIVALENT NEW COURSE
1	1	BLG3511Introduction to Biology	BLG3511 Introduction to Biology
	2	BLG3512 Diversity of Life	BLG3512 Diversity of Life
2	1	BLG3611Animal Form and Function	BLG 3611 Animal Form and Function
		MBL3631Cell Molecular Biology and Genetics	MBL3631Cell Molecular Biology and Genetics
		STS3621Statistics for Life Sciences I	BLG3621Biometrics I
		None/New Course	MBL3611Microbial Systematics
		EBL3631 Introduction to Ecology	EBL3631 Introduction to Ecology
	2	BLG3612 Plant Form and Function	BLG3612 Plant Form and Function
		MBL3632 Introduction to Microbiology	MBL3632 Introduction to Microbiology
		STS3622 Statistics for Life Sciences II	BLG3622 Biometrics II
		EBL3632 Ecological Field Techniques	EBL3632 Ecological Field Techniques
3	1	None/New course	BLG3701Microbial Ecology
		MBL3752 Comparative animal physiology	No equivalent student has to repeat module
		MBL3751Plant physiology	No equivalent student has to repeat module
		None	MBL3771Physiology
		EBL3711 Fresh Water & Marine Ecology	EBL3751Aquatic Ecology
		None	EBL3721Biosystematics I
		EBL3732 Conservation Biology and Biodiversity	EBL3771Conservation Biology and Biodiversity
		None/New course	EBL3741Ecological systems and Climate Change
		BLG3702 Research Methodology	BLG3702 Research Methodology
		EBL3712 Ecosystem Ecology	EBL3712 Ecosystem Ecology
		None	EBL3722 Biosystematics II
		None new module	EBL3752 Ecophysiology
		EBL3731 Population Ecology	No equivalent student has to repeat module
4	1 & 2	BLG3810 Research Project	BLG3810 Research Project
		None	MIC3800 Internship
		EBL3700 Field Ecology I	No equivalent student has to repeat the module
		EBL3800 Field Ecology II	No equivalent students have to repeat the module
		None	EBF3800 Field Ecology
		None	MBL3801Bioinformatics
		EBL3811 Environmental Management	No equivalent student has to repeat the module
		EBL3831Biosystematics	No equivalent student has to repeat the module
		MBL3811 Immunology	MBL3812 Immunology
		MBL3831 Applied Molecular Biology	No equivalent students have to repeat the module
		None	EBL3871Population Ecology
		EBL3851 Biogeography	EBL3851Biogeography
		None	EBL3841 Integrated Natural Resources Management I
	2	MIC3832 Virology	No equivalent student has to repeat module
		None	MIC3842 Virology
		MIC3822 Medical Microbiology	MIC3862 Medical Bacteriology
		MOL3812 Applied Genetics	No equivalent student has to repeat module
		MIC3802 Parasitology	No equivalent student has to repeat module
		None	MIC3852 Parasitology
		None	MIC3872 Developmental Biology
		MOL3852 Animal growth and development	No equivalent student has to repeat module
		MOL3832 Plant growth and development	No equivalent student has to repeat module
		EBL3832 Management of Natural Resources	No equivalent student has to repeat the module
		None	EBL3852 Integrated Natural Resources Management II
		EBL3802 Disturbance & Restoration Ecology	EBL3802 Disturbance & Restoration Ecology
		EBL3812 Behavioural Ecology	EBL3812 Behavioural Ecology
		None/New module	EBL3822 Entomology

E.4. HONOURS 11BEBA PROGRAMME REGULATIONS

E.4.1 PURPOSE AND RATIONALE OF THE QUALIFICATION

The purpose of this qualification is to provide an opportunity for holders of a level 7 degree in Environmental Biology or a pre-NQF degree in Environmental Biology to upgrade to a level 8 honours degree. The purpose of this qualification is to assist our old alumni in terms of improved job placement and promotion prospects in addition to feeding our post-graduate programmes that now require NQF level 8 degrees as minimum entry.

This programme will provide prospective students with the necessary technical skills, scientific knowledge and exposure to allow the students to be able to solve practical problems of scientific nature in Namibia and beyond. In addition, this programme gives students sufficient background to be able to take up postgraduate training at tertiary institutions.

For Environmental Biology, the main goal of this programme is to produce graduates that are well trained to be able to fit into various employment sectors namely, agricultural sector, human health, biological industries, scientific research institutes, environment sectors.

E.4.2. ADMISSION REQUIREMENTS

Applicant must be in possession of either

a) a BSc degree in Environmental Biology / Microbiology at NQF level 7

   or

b) a pre-NQF BSc degree in Environmental Biology / Microbiology or equivalent qualification from a recognised institution.

c) Students who have completed a double major Bachelor degree may be required to register for a number of undergraduate modules for non-degree purposes in order to gain admission into this programme.

E.4.3. ASSESSMENT CRITERIA

A combination of continuous assessment (40%) and an examination (60%) will be used to assess each of the typical modules in this programme and details are further specified under respective module descriptors. Assessment criteria are based on written examinations, written tests, assignments, laboratory practicals, field reports, or seminar presentations, as may be stated under each Module descriptor below. A minimum of 80% attendance of lectures is required; practical sessions are all compulsory.

E.4.4. MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE FACULTY

To be re-admitted to the Faculty of Science for a second year of registration, a student must have passed a minimum of 64 credits by the end of the first year.

E.4.5. ADVANCEMENT AND PROGRESSION RULES

Not applicable as this is a one-year program.

E.4.6. DURATION OF STUDY

The minimum duration of the study is one year and the maximum duration is two years

E.4.7. REQUIREMENTS FOR QUALIFICATION AWARD

This qualification will be awarded to candidates who passed all prescribed modules in the curriculum framework.

E.4.8. EXEMPTIONS

Unam will give exemptions for equivalent courses taken at other tertiary instituions but the exemptions shall not exceed 50% of the programme in line with the general Informnation and Regulations Prospectus.

E.4.9 CLASS ATTENDANCE

In order to be admitted to examinations, students are required to attend at elast 80% of the lectures and to complete the requored elements that make up the continuous assessment mark. Hundred % attendance of practocals classes are required.

E.5. BACHELOR OF SCIENCE ENVIRONMENTAL BIOLOGY HONOURS 11BEBA

TABLE FOR ALL MODULES IN THE PROGRAMME

Module code	Module name	NQF Level	Credits	Contact Time	*(Co-requisite) / Pre-requisite
Semester 1					
EBL3841	Integrated Natural Resources Management I	8	8	2L 1P/T (once fortnightly)	EBL3871 / EBL3712, EBL3771
EBL3871	Population Ecology	8	16	4L 1P	EBL3712, EBL3771
EBL3851	Biogeography	8	16	4L 1P	EBL3712
Total Credits Semester 1			**40**		

Module code	Module name	NQF Level	Credits	Contact Time	*(Co-requisite) / Pre-requisite
Semester 2					
EBL3852	Integrated Natural Resources Management II	8	16	4L 1P	EBL3871 / EBL3712, EBL3771
EBL3812	Behavioural Ecology	8	16	4L 1P	EBL3712 OR EBE 3772
EBL3822	Entomology	8	8	1P/T (once fortnightly)	EBL 3722
Total credits Semester 2			**40**		

Module code	Module name	NQF Level	Credits	Contact Time	*(Co-requisite) / Pre-requisite
Full Year Modules Semester 1 & 2					
EBL3800	Field Ecology	8	16	4 weeks field trip (2 weeks / semester)	EBL3841 , EBL3871 / EBL3712, EBL3771, EBL 3752
BLG3880	Research Methodology and Project	8	38		BLG 3702
Total Credits Full year Modules Semester 1 & 2			**54**		
TOTAL CREDITS FOR THE PROGRAMME			**134**		

***All co- and pre-requisites as indicated in the module descriptors in this programme are superseded by the admission requirements indicated under point 16.**

E.5.1. SERVICE COURSES FOR EDUCATION STUDENTS ONLY

EBE3772 ENVIRONMENTAL BIOLOGY FOR EDUCATORS

Course Title:	**ENVIRONMENTAL BIOLOGY FOR EDUCATORS**
Course Code:	**EBE3772**
Course equivalent:	EBE3772 ENVIRONMENTAL BIOLOGY FOR EDUCATORS
NQF Level:	7
Contact hours:	4 lecture periods / week for one semester and 1x3hour practical session per week for one semester
Credits:	16
Course Assessment:	Continuous assessment **40%**: Practicals (at least 10 assessed practicals), Theory (2 tests) Examination **60%**: 1x3 hour theory paper
Prerequisite:	**BLG3611** Animal Form and Function, **BLG3612** Plant Form and Function

Course description: This course is designed to equip students with the necessary understanding of various topics in environmental studies. The main focus of this course is to enhance understanding of relationships of organisms with one another and with their environment including the human dimension. The following will be covered in this course: Ecology and environment: Definitions. Basic components of ecological systems, essential processes of ecological systems: photosynthesis and decomposition. Primary and secondary production, energy flow and flux of matter and trophic structures, food chains and food webs, trophic levels and ecological pyramids, Food chains and poisons in the environment.Biogeochemical cycles (water-, carbon and nitrogen-cycles) and human influence on these cycles. Population Ecology: characteristics of populations- birth, death, immigration, emigration, size, age structure, and sex ratios. Population density, dispersion, mortality, natality and survivorship, population growth, parasitism.Population regulation (mechanisms of population regulation, intra-specific competition, dispersal, social interactions).Ecosystems and Biomes: definitions, classification and characteristics of various biomes of the world. Biomes of Namibia.Climate change: definition, causes, mitigation and adaptations. Desertification: definitions, causes of desertification (proximate or immediate and ultimate or underlying causes), manifestations of desertification, action to combat desertification. Deforestation: causes (proximate or immediate and ultimate or underlying causes) and effects of deforestation, deforestation in Namibia and possible solutions to deforestation. Conservation ecology: definitions, global patterns, distribution and measurement of biodiversity. Sustainable development.Threats to biological diversity (including habitat destruction, habitat fragmentation, habitat degradation and pollution, global climate change, overexploitation, invasive and alien species, and disease).Human influences on ecosystems; damage to the environment, urbanization.

EBE3801 ENVIRONMENTAL EDUCATION

Course Title:	**ENVIRONMENTAL EDUCATION**
Course Code:	**EBE3801**
Course equivalent:	**N**one – New course
NQF Level:	8
Contact hours:	2 lecture periods / week for one semester and 1x3hour practical session every second week for one semester. However this course is taught as a block during the second half of the first semester
Credits:	8
Course Assessment:	Continuous assessment 40%: Practicals (at least 10 assessed practicals), Theory (2 tests) Examination 60%: 1x3 hour theory paper
Prerequisite:	None

Course description: The course will expose eduation students to environmental education. Most of the content is practical and the following will be covered: <u>Definitions:</u> Education for sustainable development; Environmental Education; Sustainability; Biodiversity; Extinction; Endangered species; Conservation. <u>Environmental issues/problems and how culture impact on the environment:</u> Climate change; deforestation; desertification; greenhouse effect; pollution; Solutions and alternatives to environmental issues/problemsEnvironmental protocols; conventions, treaties; charters and agendasDevelopment of learning materials to aid environmental education in the classroom including how to take learning activities to the outdoors and the integration of environmental education into various subjects.

E.6. B.SC. INTEGRATED ENVIRONMENTAL SCIENCE (HONS) (OGONGO CAMPUS) [17BSIE]

All modules listed below, except English Communication and Study Skills, English for Academic Purposes and Contemporary Social Issues, will be offered by Faculty of Science. English Communication and Study Skills, English for Academic Purposes, Contemporary Social Issues and Computer Literacy are University Core Modules taken by all First Year University of Namibia students.

E.6.1 ADMISSION CRITERIA FOR BACHELOR OF SCIENCE IN INTEGRATED ENVIRONMENTAL SCIENCE (HONOURS)

E.6.2 First Year to Second Year

(a) To proceed to second year, a student must have passed at least 96 credits prescribed in the first year (67% of the total 136 credits in first year).

(b) A student who has obtained at least 48 but less than 56 credits by the end of the first year shall not progress to second year, but re-register for all outstanding modules first year modules. Such student will not be allowed to register for any modules in the second year.

(c) A student who has obtained at least 56 but less than 96 second year credits shall repeat the year, but will be allowed to register for a maximum of 48 credits in the 2nd year in addition to the failed modules provided that the relevant pre-requisites have been passed.

E.6.3 Second Year to Third Year

(a) To proceed to third year, a student must have passed at least 50% of the remaining first year credits and at least 120 credits in second year (75% of the total 156 credits in second year).

(b) A student who has obtained at least 56 but less than 64 second year credits by the end of the second shall repeat the year and re-register for all outstanding modules. Such student will not be allowed to register for any modules in the third year.

(c) A student who has obtained at least 64 but less than 120 second year credits shall repeat the year, but will be allowed to register for a maximum of 48 credits in the third year in addition to the failed modules of the second year provided that the relevant pre-requisites have been passed.

E.6.4 Third Year to Fourth Year

(a) To proceed to fourth year, a student must pass all first year modules and at least 50% of the remaining second year credits. In addition, the student must have passed at least 96 third year credits (75% of the total 126 credits in year third).

E.5.3.4 EXEMPTIONS

On the completion of the **UNAM Diploma in Natural Resource Management (17HDNR),** students will receive credits for the following first and second year courses in **Bachelor of Science in Integrated Environmental Science (17BSIE).** Students could register for modules in the Second Year and Third Year in addition to the following modules: English for Academic Purpose, Basic Mathematics, Principles of Micro Economics, General Microbiology, Ecology, Genetics, and Biostatistics.
The list of equivalents for which credits (Exemption) will be given is listed below:

Diploma in Natural Resources Management	Bachelor of Science in Integrated Environmental Science Honours
Course	Course
LEG2410 English for General Communication	LCE3419 English for Communication and Study Skills
CLC3509 Computer Literacy	CLC3509 Computer Literacy
CSI3580 Contemporary Social Issues	CSI3580 Contemporary Social Issues
AEC521 Intro to Rural Sociology **AEC2422 Comm. and Info Systems** **AEC2601 Extension Methods**	AEC3691 Rural Sociology
ASC2431 Biology	BLG3511 Introduction to Biology
ASC2431 Biology **CSC2412 Principles of Crop Production** **ASC2502 Applied Animal Breeding** **ASC2411 Physical Science**	BLG3512 Diversity of Life
CSC2581 Soil Science **CSC2601 Water Management and Soil Conservation**	CHM3532 Chemistry for Life Science
NONE	IES3691 Environmental Science
IES2672 Economics of Natural Resources	FAN3682 Natural Resources Economics

E.6.5 PROGRAMME SCHEDULE

YEAR 1

COURSE CODES	COURSE	NQF Level	PRE-REQUISITES	CREDITS	CO-REQUISITES
Year 1 Semester 1					
CLC3509	Computer Literacy	5		8	None
LCE3419	English Communication & Study Skills	4		16	None
CSI3580	Contemporary Social Issues	5		8	None
BLG3511	Introduction to Biology	5		16	None
MAT3511	Basic Mathematics	5		16	None
Year 1 Semester 2					
LEA3519	English for Academic Purposes	5		16	None
CHM3532	Chemistry for Life Sciences	5		16	None
BLG3512	Diversity of Life	5		16	None
MAT3512	Pre-Calculus	5		16	None
Total Credits				**128**	

YEAR 2

COURSE CODES	COURSE	NQF Level	PRE-REQUISITES	CREDITS	CO-REQUISITES
Year 2 Semester 1					
AEC3681	Principles of Micro Economics	6		12	None
AEC3691	Rural Sociology	6		12	None
ASC 3681	Genetics	6		12	None
FST 3681	General Microbiology	6		12	None
CRS 3681	Biostatistics	6		12	
IES3681	Ecology	6		12	
IES3691	Environmental Science	6		12	None
Year 2 Semester 2					
AEC3692	Principles of Macro Economics	6		12	None
CRS3682	Soil Science for Crop Production	6		12	None
ASC 3612	Biochemistry	6	CHM3532	16	
IES3682	Plant Physiology	6		12	
FAN3682	Natural Resource Economics	6		12	
IES3622	Climatology and Hydrology	6		8	
Total Credits				**128**	

YEAR 3

COURSE CODES	COURSE	NQF Level	PRE-REQUISITES	CREDITS	CO-REQUISITES
Year 3 Semester 1					
ACA3701	Field Attachment 1	7		8	None
IED 3781	Dryland Plants	7		12	None
IEP 3781	Principles of Wildlife Management	7		12	None
IES 3791	Geo-informatics	7		12	None
AIEA 3781	Agroforestry	7		12	
Year 3 Semester 2					
IEN 3792	Nature Conservation	7		12	None
IEN3782	Natural Resource Governance	7		12	None
IES 3702	Community Based Resource Management	7		8	None
CSC 3792	Research Methods	7	**CRS3681**	12	None
AEC 3712	Agricultural Extension	7	**AEC3791**	16	None
Total Credits				**116**	

YEAR 4

E.6.1 FORESTRY OPTION

COURSE CODES	COURSE	NQF Level	PRE-REQUISITES	CREDITS	CO-REQUISITES
Year 4 Semester 1					
ACA3701	Field Attachment II*	8		8	None
FOR3810	Research Project (Forestry)	8		32	None
FOR3881	Silviculture	8		12	None
FOR3891	Forest Protection	8		12	None
FOF3881	Forest Mensuration	8		12	
Year 4 Semester 2					
AEC3881	Project Planning & Management	8		12	None
FOR3882	Forest Inventory	8		16	None
FOR3812	Forest Economics & Marketing	8		12	None
FOR3892	Forest Management	8		12	None
FOR3882	Forest Inventory	8		12	None
Total Credits				**128**	

E.6.2 ENVIRONMENTAL SCIENCE OPTION

COURSE CODES	COURSE	NQF Level	PRE-REQUISITES	CREDITS	CO-REQUISITES
Year 4 Semester 1					
ACA3701	Field Attachment II*	8		8	None
ENV3810	Research Project (Environmental Science)	8		32	None
ENV3881	Environmental & Development	8		12	None
ENV3891	Environmental Pollution Control	8		12	None
ENV3801	Watershed Management	8		12	
AEC3881	Project Planning & Management	8		12	
Year 4 Semester 2					
ENV3882	Management of Arid and Semi-Arid Lands	8		12	None
ENP3882	Environmental Planning & Management	8		16	None
ENE3882	Environmental Impact Assessment	8		12	None
ENE3892	Environmental Education	8		12	None
Total Credits				**132**	

E.6.7 MODULE DESCRIPTORS

E.6.7.1 FIRST YEAR MODULES

CLC3509 COMPUTER LITERACY

Module title: **COMPUTER LITERACY**
Code: **CLC3509**
NQF level: 5
Contact hours: 1 lecture theory and 1 lecture practical per week for 14 weeks
Credits: 8
Module assessment: Continuous Assessment 100%: 2 Practical Tests 50%, 2 Theory Tests 50%
Prerequisites: **University Entry**
Module Content:
The module covers the following topics. Introduction to Computers: hardware and software, types and categories of computers, usage of Computer devices and peripherals. Working with the windows operating system: File Management, working with multiple programs, using the recycle bin. Using a word processor: formatting a text and documents, spelling check, grammar and thesaurus tools, inserting tables, auto-shapes, clip arts, charts, and mail merge. Spreadsheet: worksheets and workbooks, ranges, formulas and functions, creating graphs, charts, and printing the workbook. Databases: creating tables, relationships, queries, forms and reports. Presentation software: slide layout and master, animations, auto-content wizard and templates. Communication tools: introduction to the Internet, web browsers, search engines, downloading and uploading files, creating and sending messages, email etiquette, internet security, and digital signatures.

LCE3419 ENGLISH COMMUNICATION & STUDY SKILLS

Module title: **ENGLISH COMMUNICATION AND STUDY SKILLS**
Code: **LCE3419**
NQF Level: 4
Contact hours: 4 hours per week for 14 weeks
Credits: 16
Module Assessment: Continuous assessment (60%): two tests (reading and writing), two reading assignments, one oral presentation Examination (40%): one three hour examination paper
Pre-requisites: **None**

Module Content:
This module is aimed at assisting students in the development of their reading, writing and speaking and listening skills, in order to cope with studying in a new academic environment and in a language which may not be their first language. The module also focuses on study skills that students need throughout their academic careers and beyond. The module serves as an introduction to university level academics, where styles of teaching and learning differ from those at secondary schools in that more responsibility is placed on the student. The module therefore, focuses on the skills that students need throughout their academic careers and beyond.

CSI3580 CONTEMPORARY SOCIAL ISSUES

Module title: **Contemporary Social Issues**
Code **CSI 3580**
NQF Level: 5
Contact hours: Equivalent to 1 hour per week for two semesters (Online)
NQF Credits: 8
Prerequisite: None (University Core Module)
Compulsory/Elective Compulsory
Semester Offered: 1 & 2 (Year Module)
Module Descriptor (Rationale of the module):
The module, Contemporary Social Issues (CSI3580), is designed to encourage behavioural change among UNAM students and inculcate the primacy of moral reasoning in their social relations and their academic lives. In providing students with critical and

analytical thinking the module enables students to grow and develop into well rounded citizens, capable of solving contemporary social challenges experienced in their communities and societies. The teaching of the module takes three dimensions: the intellectual, the professional and the personal dimensions. The intellectual dimension is fostered through engaging students with subject knowledge, independent learning and module assessment. The professional dimension, on the other hand, is fostered through exposing students to real life situations of case studies and practical exercises that draws attention to social issues that attract ongoing political, public and media attention and/or debate. Finally, the professional dimension is fostered through group work, online discussions and class participation.

BLG3511 INTRODUCTION TO BIOLOGY

Module title: **INTRODUCTION TO BIOLOGY**
Code: **BLG 3511**
Course Equivalent: Biology 1A
NQF level: 4
Contact hours: 4 lectures/ week for 14 weeks and one 3-hour practical session per week.
Credits: 16
Module assessment: Continuous assessment (40%): Theory (not less than 3 tests and 2 assignments), 40%. Practicals (not less than 10 marked assignment), 60%. Examination (60%): 3 hour examination paper.
Prerequisites: NSCC (Biology C or better)
Module Content:
It will consider organization of life, chemical basis of life, carbohydrates, proteins, nucleic acids, lipids and fats, water, cell structure and function, prokaryotic and eukaryotic cells, ultra-structure of plant and animal cells, cytoskeleton, membrane structure and function, cell communication, mitosis, meiosis, cell reproduction, cell cycle, and cell death.
The following topics will be covered: Introduction to systems of classification, taxonomy and binomial nomenclature, including the five kingdoms and the three domein system. Definitions and categories/groups within the five kingdoms, evolution by natural selection (microevolution vs macroevolution), phylogeny and evolutionary relationships in five kingdoms. The course content will also include genes, chromosomes, genomes, Mendelian genetics, extensions to Mendelian genetics, chromosome theory of inheritance, linkage and cross-over, recombination, sex determination. The course content will also cover an introduction to Ecology: Definitions, history, scales in ecology, application of ecology. Conditions and Resources: Environmental conditions, animals and their resources, plants and their resources.

MAT3511 BASIC MATHEMATICS

Module Title: **BASIC MATHEMATICS**
Code: **MAT 3511**
NQF level: 5
Contact hours: 4 lectures per week for 14 weeks; 2 tutorials per week for 14 weeks
Credits: 16
Module Assessment: Continuous assessment 50% (at least 3 tests), examination 50% (3 hours examination paper).
Prerequisite: **NSSC Mathematics**
Module Content:
Sets: notations and diagrams to represent sets, subset, empty set, equality of sets, intersection, union, complement.
Algebraic expressions: simplification, expansion, polynomials, reminder and factor theorem, partial fractions.
Trigonometry: trigonometric functions, basic trigonometric identities. The absolute value, linear equations, linear inequalities, quadratic equations, the quadratic formula, quadratic inequalities. Functions: domain, codomain, image, preimage, even function, odd function. Sequences: the general term, the geometric sequence, the arithmetic sequence. The Binomial Theorem.

LEA3519 ENGLISH FOR ACADEMIC PURPOSES

Module title: **ENGLISH FOR ACADEMIC PURPOSES**
Code: **LEA3519**
NQF level: 5
Contact hours: 4 periods per week for 14 weeks
Credits: 16
Module assessment: Continuous assessment (60%): 2 tests (reading and writing), 1 academic written essay,1 oral Presentation Examination (40%) : One three hour examination paper
Prerequisites: None
Module Content:
This module develops a student's understanding, and competencies regarding academic conventions such as academic reading, writing, listening and oral presentation skills for academic purposes. Students are required to produce a referenced and researched essay written in formal academic style within the context of their university studies. Students are also required to do oral presentations based on their essays. The reading component of the course deals with academic level texts. This involves students in a detailed critical analysis of such texts. The main aim is therefore, to develop academic literacy in English.

CHM3532 CHEMISTRY FOR LIFE SCIENCE

Module Title: CHEMISTRY FOR LIFE SCIENCES
Code: SCHM3532
NQF Level: 5
Contact Hours: 56 hours of lectures, 42 hours of practical sessions.
Credits: 16
Module Assessment: CA: 50% (minimum 3 tests 80%, laboratory component 20%, tutorial assignments 10%). Final Exam: 50%; (1 x 3 hour exam paper)
Pre-requisites: None
Module Aims:
This module is designed for students that have insufficient background in chemistry and for non-chemistry majors .It is an introduction to topics in general and organic chemistry, and biochemistry. The following will be covered:

Module Content:
Classification of Matter: Mixtures and Pure substances; Physical States of Matter; Physical and Chemical Properties. Extensive and Intensive properties. Measurements: Units, Significant figures; Precision and Accuracy, Factor Label Method. Atomic structure and the Periodic table; Electron configuration; Physical and Chemical properties as predicted from groups. Ionic compounds and Molecular compounds: Writing chemical formulae and naming of ionic and molecular compounds. Average Atomic Mass. The Mole Concept; Percent Composition, Empirical formula and Molecular formula. Stoichiometry: limiting reagent, percent yield. Solutions: electrolytes and non-electrolytes, aqueous solutions, ionic equations; concentrations: percent concentration; molarity, molality; dilution of solutions; structure and solubility. Types of bonds; Lewis structures; Resonance structures; Molecular geometry: the VSEPR model, Polarity of molecules. Acid-base equilibrium: properties of acids and bases; relations of acids and bases, self ionisation of water; strengths of acids and bases; the pH scale; hydrolysis of salts; buffers; acid-base titration. Introduction to organic chemistry: organic compounds; structural formulae and conformations; functional groups; Classes of hydrocarbons: alkanes, cycloalkanes: alkanes; alkenes and alkynes; oxidation and reduction; addition reactions; stereo-isomerism. Alcohols, phenols, thiols, ethers: organic compounds of oxygen; common alcohols and phenols. Carboxylic acids and esters, amines and amides: Introduction to carbohydrates, lipids and porphyrins.

BLG3512 DIVERSITY OF LIFE

Module title:	**DIVERSITY OF LIFE**
Code:	**BLG 3512**
Course Equivalent:	NSSC (/HIGH GRADE) Biology
NQF level:	5
Contact hours:	4 lecture periods / week for 14 weeks and one three hour practical session per week
Credits:	16
Module assessment:	Continuous assessment: Theory (not less than 3 tests and 2 Assignments) 40% Practicals (not less that 10 marked assignments) 50% Examination: 60% (1 x 2 hour examination paper)
Prerequisites:	NSCC (Biology C or better)

Module Content:
This module is designed to give students a detailed understanding of the diversity of life. It gives students the broader appreciation of biodiversity in the different ecological habitats. The course shall describe diagnostic characteristics of principle taxonomic categories for each phylum. Coverage of each Phylum shall follow a phylogenetic (evolutionary) approach as well as introduce broad ecological and physiological principles. Various aspects of reproduction and development shall be highlighted. This module prepares students to understand subsequent courses such as Introduction to Ecology and Microbiology, Population Ecology, Comparative physiology, Biogeography, Plant and Animal Form and Function

Topics covered will include viral, bacterial, fungal, algal, animal and plant diversity. It then considers the characteristics and life cycles of the following important algae, animal and plant groups: Chlorophyta, Phaeophyta, Rhodophyta, Chrysophyta, Euglenophyta, Pyrrophyta, Cryptophyta, Protostomate phyla: Nemertea, Mollusca, Anellida, Arthropoda, Nematoda, Rotifera, Lophophorates, Onychophora. Deuterostomate phyla: Echinodermata, Hemichordata and Chordata (Subphyla: Urochordata, Cephalochordata and Vertebrata: Class Myxiniformes, Petromyzontiformes, Placoderms, Chodrichthyes, Actinopterygii, Actinistia, Dipnoi, Amphibia, Reptilia, Aves, Mammalia) bryophytes, seedless vascular plants, gymnosperms, and the angiosperms. Concepts such as Homology and analogy; body symmetry (radial, bilateral), cephalisation, body cavities: diploblastic, triploblastic (acoelomate and coelomate [deuterostomes and protostomes]) will be covered.
Examples from Namibia shall be used where possible and applicable. The course content shall be supplemented with appropriate weekly practical sessions in the laboratory and in the field.

MAT3512 PRE-CALCULUS

Module Title:	**PRE-CALCULUS**
Code:	**MAT 3512**
NQF level:	5
Contact hours:	4 lectures per week for 14 weeks; 2 tutorials per week for 14 weeks
Credits:	16
Assessment:	Continuous assessment 50% (at least 3 tests), examination 50% (3 hours examination paper).
Prerequisite:	NSSC Mathematics

Module Content:
Functions: one-to-one and onto functions, horizontal line test, composition of functions, inverse of a function.
Introduction to exponential and logarithmic functions. Limit of a function: definition, left and right limits, infinite limits, limits at infinity, continuity in terms of limits. Differentiation: rate of change, derivative of a function, rules of differentiation, increasing and decreasing functions and graph sketching. Integration: antiderivatives, the definite integral, area under a graph. Trigonometry: further trigonometric identities, area of a sector and segment of a circle, derivatives and integrals of trigonometric functions.
(Although the above information has been compiled as accurately as possible, the Faculty of Agriculture and Natural Resources cannot be held responsible for any errors and/or omissions which may occur in the above module descriptors of modules offered by other Departments.)

E.6.7.2 SECOND YEAR MODULES

AEC3681 PRINCIPLES OF MICROECONOMICS

Module Title:	**PRINCIPLES OF MICROECONOMICS**
Code:	AEC 3681
NQF level:	6
Contact hours	Lectures: 3x 1hr L/wk for 14 weeks (42hrs)
NQF Credits:	12
Prerequisites:	None
Compulsory/Elective	Compulsory
Semester Offered:	1

Module Content:
The course includes issues such as: introduction to the concept of scarcity, consumer theory, choices under uncertainty, theory of production, cost and output, the theory of the firm under perfect competition, supply and demand analysis, market structures (competitive markets, monopolistic, monopoly and oligopoly), general equilibrium analysis and efficiency, externalities, and public goods.
Assessment Strategies
Continuous assessment 40% (minimum 2 tests and 1 assignment) **Examination** 60% (1 x 2 hour paper)

AEC3682 PRINCIPLES OF MICROECONOMICS

Module Title:	**PRINCIPLES OF MACROECONOMICS**
Code:	AEC 3682
NQF level:	6
Contact hours	Lectures: 3x 1hr L/wk for 14 weeks (42hrs)
NQF Credits:	12
Prerequisites:	None
Compulsory/Elective	Compulsory
Semester Offered:	2

Module Content:
The course includes issues such as: price indices, inflation, real and nominal values, national accounting, determination of aggregate demand and supply, consumption, investment, and savings; it also presents fiscal and monetary policies, government spending, taxation, budget deficits, interest rates, money and banking and balance of payments, employment and business cycles. It provides an overview of the position of the agriculture and fishing sectors in the national economy.
Assessment Strategies
Continuous assessment 40% (minimum 2 tests and 1 assignment) **Examination** 60% (1 x 2 hour paper)

AEC3691 RURAL SOCIOLOGY

Module Title:	**RURAL SOCIOLOGY**
Code:	AEC 3691
NQF level:	6
Contact hours:	Lectures: 3x 1hr L/wk for 14 weeks (42hrs)
NQF Credits:	12
Prerequisites:	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:
This module investigates the basic sociological concepts and their application to agricultural progress and rural development planning; the significance of rural sociology to agricultural extension and rural development; differences between rural and urban population; culture and culture change, social interaction and social structures; groups and organization, deviance, social class and stratification; Social institutions families; religions; rural/urban migration and environment; social change in global perspective.
Assessment Strategies
Continuous assessment 40% (minimum 2 tests and 1 assignment) **Examination** 60% (1 x 2 hour paper)

ASC3681 GENETICS

Module Title:	**GENETICS**
Code:	ASC 3681
NQF level:	6
Contact hours:	Lectures: 3x 1hr L/wk for 14 weeks (42hrs); Practicals: 1 x 3hr Practical alternate wk for 14 weeks (21hrs)
NQF Credits:	12
Prerequisites:	None
Compulsory/Elective:	Compulsory
Semester offered:	1

Module Content:
This module covers Extension of Mendelian analysis and ratio – incomplete dominance, co-dominance, multiple alleles, gene interactions, pleiotropy, epistasis, lethal genes; Chromosome (Physical structure, Packaging, Karyotype and Variations); The Cell Cycle; Mitosis and its genetic significance; Meiosis and its genetic significance; Sex determination; Sex linkage and general examples of sex-linked inheritance; The molecular structure of DNA - the double helix model; DNA replication in prokaryotes and eukaryotes; Gene expression (Transcription and Translation); Regulation of gene expression – The Lac operon; Mutations (types, causes, detection and significance). The module also introduces students to basic molecular biology concepts. It examines molecular organization of the genomes (prokaryotes and eukaryotes) and molecular structure of genes; it introduces DNA based technology such as Polymerase Chain Reaction (PCR), DNA extraction, electrophoresis, sequencing, genetic engineering and animal cloning.
Assessment Strategies
Continuous Assessment: 40% (2x assignments + 2 tests + at least 5x marked practicals). **Exam:** 60% (1 x 2 hr paper).

IES3681 ECOLOGY

Module Title: **ECOLOGY**
Code: IES 3681
NQF level: 6
Contact hours: Lectures: 3 x 1hr/wk for 14 weeks (42 hrs); Practicals: 1 x 3 hrs alternate for 14 weeks (21hrs)
NQF Credits: 12
Prerequisites: None
Compulsory/Elective: Compulsory
Semester offered: 1

Module Content:

Ecological concepts.Physical, chemical and biological parameters of the environment.Population characteristics; Sex ratio, age distribution, growth rate, Population processes, growth models; density dependent and independent population regulation. Estimating population size, life-table analysis, survivorship. Ecosystem processes: Trophic levels, Biomass, Nutrient cycling. Community ecology: Classification of communities (biogeoclimatic classification applied to Namibia), Diversity and its measurements. Conservation guilds (keystone, flagship and umbrella species).Habitat utilization.Dynamics (ecological succession) and stability.

Assessment strategies

Continuous assessment: 40% (At least three assessments); **Exam:** 60% (1 x 3hr paper)

IES3691 ENVIRONMENTAL SCIENCE

Module Title: **ENVIRONMENTAL SCIENCE**
Code: IES 3691
NQF level: 6
Contact hours: Lectures: 3 x 1hr/wk for 14 weeks (42 hrs); Practicals: 1 x 3 hrs alternate for 14 weeks (21hrs)
NQF Credits: 12
Prerequisites None
Compulsory/Elective: Compulsory
Semester Offered: 1

Module Content:

The concepts of; environment, natural resources, demography and land use. Major environmental concerns including pollution, soil erosion and degradation in crop and livestock production systems (Namibian context).Effects ofagrochemicals, desertification and methods of control, natural and man-made hazards.Effects of; human population growth, industrialization and urbanization on the environment.Energy sources and their environmental impacts.Waste management.Climate change and the environment.

Assessment Strategies

Continuous assessment 40% (At least three assessments) **Examination** 60% (1 x 3 hour paper)

FST3681 GENERAL MICROBIOLOGY

Module Title: **GENERAL MICROBIOLOGY**
Code: FST 3681
NQF Level: 6
Contact hours: Lecture: 3 x 1hr/wk for 14 weeks (42 hrs): Practicals: 1 x 3 hrs alternate for 14 weeks (21hrs
NQF Credits: 12
Prerequisite: None
Compulsory/Elective: Compulsory
Semester Offered: 1

Module Content:

This course provides a student with a general overview of microbiology including their environment, classifications, their morphology, structures and chemical composition. The biology of bacteria, fungi, algae, protozoa and viruses.Effect of antibiotics on microorganisms, important pathogens of plants and animals.The role of microorganisms in general industries, food industries and in the soils.Concept of microbiology with special reference to microscopy, staining procedure, sterilization, aseptic, pure culture techniques and media preparation.

Assessment Strategies

Continuous Assessment: 40% (minimum 2 tests, 2 assignments and 4 practicals). **Examination:** 60% (1 x 3 hr paper)

ASC3612 BIOCHEMISTRY

Module Title: **BIOCHEMISTRY**
Code: ASC 3612
NQF Level: 6
Contact hours: Lectures: 4x 1hr L/wk for 14 weeks (56hrs); Practicals: 1 x 3hr Prac/wk for 14 weeks (42hrs)
NQF Credits: 16
Prerequisite: Chemistry for Life Sciences (CHM 3532)
Compulsory/Elective: Compulsory
Semester Offered: 2

Module Content:

Under this course the students will learn about Physical biochemistry including acids, bases, buffers and pH; Structural biochemistry - learning about the Structure and function of carbohydrates, proteins and lipids. Bioenergetics and Thermodynamics (Free energy, Laws of energy, Endergonic and exergonic reactions); Enzymology (Enzymes as organic catalysts Enzyme nomenclature Enzyme kinetics Factors affecting activities of enzymes The Michaelis-Menten equation The Lineweaver-Burk plot Enzyme inhibition Competitive inhibition Non competitive inhibition Enzyme activity regulation Allosterism Cofactors); Vitamins and coenzymes (Water-soluble vitamins Fat-soluble vitamins); Metabolism (Anabolism and catabolism overview Carbohydrate catabolism Glycolysis Alcohol and lactic acid fermentation Cori cycle Gluconeogenesis Synthesis of the disaccharides lactose and sucrose Synthesis of polysaccharides starch and glycogen Regulation of carbohydrate metabolism Metabolic disorders in carbohydrate metabolism Pentose phosphate pathway Tricarboxylic acid cycle Glyoxylate cycle in oily seeds Photosynthesis Electron transport system and oxidative phosphorylation Fat metabolism Integration of carbohydrate and fat metabolism); Electrophoresis.

Assessment Strategies

Continuous Assessment: 40% (2x assignments + 2 tests + at least 5x marked practicals). **Exam:** 60% (1 x 3 hr paper)

IES3622 CLIMATOLOGY AND HYDROLOGY

Module Title:	**CLIMATOLOGY AND HYDROLOGY**
Code:	IES 3622
NQF level:	6
Contact hours:	Lectures: 2x 1hr/wk for 14 weeks (28hrs); Practicals: 1 x 3hr alternate wk for 14 weeks (21hrs)
NQF Credits:	8
Prerequisites:	None
Compulsory/Elective:	Compulsory
Semester Offered:	1

Module Content:

Introduction to Climatology concepts; weather, meteorology, climate, climatology and atmosphere. Weather systems and weather forecasting; weather parameters, world weather systems, Namibia weather conditions, weather forecasting.Climate; climatic data, climatic classifications, climatic zones of the world, climatic zones of Namibia, Climate change.Hydrology; parameters and their measurement.Hydrologic cycle; elements and their estimation. Groundwater hydrology-aquifers, water table and aquifer recharge.

Assessment Strategies

Continuous Assessment: 40% (At least three assessments); **Examination**: 60% (1 x 2 hr paper)

FAS3682 NATURAL RESOURCE ECONMICS

Module Title:	**NATURAL RESOURCE ECONOMICS**
Code:	FAS 3682
NQF level:	6
Contact hours:	Lectures: 3 x 1hr/wk for 14 weeks (42hrs); Practicals: 1 x 3hr alternate wk for 14 weeks (21hrs)
NQF Credits:	12
Prerequisites:	None
Compulsory/Elective:	Compulsory
Semester Offered:	2

Module Content:

Natural resource economics: Renewable and non-renewable resources; natural- and man-made capital: Conservation and development. Sustainability: Resource scarcity and population growth; ecocentric vs. anthropocentric approach; Resource use; the precautionary use of user-pay principle; Economic growth and sustainable development. Brundtlandreport. Market failures: public goods, externalities. Valuing natural resources: surrogate market techniques, travel time, contingency valuation methods, non-use values; opportunity costs.

Assessment Strategies

Continuous Assessment: 40% (at least three assessments); **Examination:** 60% (1 x 3 hr paper)

IES3682 PLANT PHYSIOLOGY

Module Title:	**PLANT PHYSIOLOGY**
Code:	IES 3682
NQF level:	6
Contact hours:	Lectures: 3 x 1hr/wk for 14 weeks (42 hrs); Practicals: 1 x 3 hrs alternate for 14 weeks (21hrs)
NQF Credits:	12
Prerequisites:	None
Compulsory/Elective:	Compulsory
Semesteroffered:	2

Module Content:

Growth and development in plants; development of plant organs, growth hormones, flowering physiology, seed physiology and dormancy.Photosynthesis.Respiration.Plant water relations.Mineral absorption and utilization. Factors affecting plant growth and distribution. Stress physiology.

Assessment strategies

Continuous assessment: 40% (At least three assessments); **Exam:** 60% (1 x 3 hr paper)

CRS3682 SOIL SCIENCE FOR CROP PRODUCTION

Module Title:	**SOIL SCIENCE FOR CROP PRODUCATION**
Code	CRS3682
NQF Level	6
Contact hours	03 Lecture hours/week for 14 weeks; 02 Practical hours/week for 14 weeks
NQF credits	12
Prerequisites	None
Compulsory/Elective:	Compulsory
Semester offered	1

Module Content:

Definition of soil. Soil formation. Soil as a triphasic system: texture, soil organic matter, soil organisms and nutrient cycles. Clay minerals, soil colloids and cation exchange capacity; Soil structure. Bulk density. Soil moisture, soil water potential and movement in saturated and unsaturated soils; field capacity and water holding capacity. Basics of soil fertility and plant nutrition: macro- and micro-nutrients and their functions, pH and nutrient availability. Soil classification: soil profile, horizons, and influence of environmental factors. Common soil classification systems: USDA (soil taxonomy) and FAO classification systems. Major soil types

Assessment Strategies

Continuous Assessment: 40 % (minimum of 2 tests, 1 assignment, 7 practicals). Examination: 60% (01 x 02 hours paper)

E67.7.3 THIRD YEAR MODULES

IED3781 DRYLANDS PLANTS

Module Title:	**DRYLANDS PLANTS**
Code	IED 3781
NQF level	7
Contact hours	Lectures: 03 x 1 hours/week for 14 weeks (42 hrs);
NQF Credits:	12
Prerequisites:	None
Compulsory/Elective:	Compulsory
Semester offered:	1

Module Content:
Introduction to plant taxonomy; scope of plant taxonomy,classification,nomenclature, identification and herbarium practice. Taxonomy, botanical characteristics and ecology of key exotic and indigenous plant species in Namibiaincluding; timber and fuel-wood plants, fruit and food plants, fodder plants and medicinal plants (emphasis on grasses, shrubs and trees). Non-woody woodland products. Forest product development.
Assessment strategies
Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

IEP3781 PRINCIPLES OF WILDLIFE MANAGEMENT

Module Title:	**PRINCIPLES OF WILDLIFE MANAGEMENT**
Code:	IEP 3781
NQF level	7
Contact hours:	Lecturers: 3 x 1 hr/week for 14 weeks (42 hours; Practicals: 1 x 3 hr alternate for 14 weeks (21 hours)
NQF Credits:	12
Prerequisites:	None
Compulsory/Elective:	Compulsory
Semester offered:	1

Module Content:
An introduction to basic principles used in the management of wildlife populations, their habitats and their human users. General concepts in: ecological processes; population dynamics and structure; sampling in wildlife; life history patterns, biotic and abiotic factors structuring wildlife populations and endangered species.Home range and territoriality; coloniality; mating systems; hierarchy. Response of wildlife to humans.Plant-herbivore system.Herbivore-carnivore system.Predation of domestic animals by wild animals. Nutritional ecology (anatomy and physiology; feeding ecology; diet composition and analysis; nutritional value of plants; plant chemicals and toxins; management of toxic plants and affected game; grazing and browsing capacity; mineral deficiencies and supplementary feeding; nutrition in captivity). Animals and their characteristics.Management techniques of wildlife.Ranch (habitat) management.Genetic management.Wildlife management and rural development.
Assessment strategies
Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

ACA3701 FIELD ATTACHMENT

Module Title:	**FIELD ATTACHMENT I**
Code	ACA 3701
NQF Level	7
Contact hours	Six weeks of Field Attachment
NQF Credits	6
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1 and 2

Module Content:
Six weeks of field attachment; at the end of the second year, students will be attached to industries and institutions dealing with environmental/natural resource management selected to ensure that the objectives of on-site training are attained. An attachment report and oral presentation will constitute the total assessment mark. Students will be visited during their attachment on-site to check on the efficiency of attachment.
Assessment strategies: 50 % report presentation at a seminar; 50 % Field report. Subject to satisfactory attendance and good conduct during attachment.

IES3782 NATURAL RESOURCES GOVERNANCE

IES3782	**NATURAL RESOURCES GOVERNANCE**
Code	IES3782
NQF level	7
Contact hours	Lectures: 3 x 1hr/wk for 14 weeks (42hrs); Practicals: 1 x 2hr alternate for 14 weeks (14hrs)
Notional Hours	120
NQF Credits	12
Pre requisite	None
Compulsory/Elective	Compulsory
Semester offered	2

Course content
Principles of law with particular reference to environment, forestry and wildlife resources.Legal process governing environment and industrial pollution.Specific environmental acts and statutes dealing with environment, forestry and wildlife. Introduction to International environmental law and International Conventions; Policies: design, implementation, evaluation of policy impacts. Law enforcement in management of natural resources.

IEA3781 AGROFORESTRY

Module Title: **AGROFORESTRY**
Code: IEA 3781
NQF Level: 7
Contact hours: Lectures: 3 x 1hour/week for 14 weeks (42hrs); Practicals: 1 x 3 hours alternate weeks for 14 weeks (21 hours)
NQF Credits: 12
Prerequisite: None
Compulsory/Elective: Compulsory
Semester Offered: 1

Module Content:
Introduction to agroforestry; definition and principles of agroforestry, integrated land-use system, need for agroforestry, causes and consequences of deforestation. Land-use systems and possible agroforestry intervention.Multi-purpose tree species and their uses.Agroforestry systems and practices including apiculture.Agroforestry demonstration plots.Ecological and economic interactions.Agroforestry development in

Assessment strategies:
Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

CRS3681 BIOSTATISTICS

Module Title: **BIOSTATISTICS**
Code CRS 3681
NQF Level 7
Contact hours 3 lecture hours / week for 14 weeks; 3 tutorial / practical hours alternate weeks for 14
NQF Credits 12
Prerequisite None
Compulsory/Elective Compulsory
Semester Offered 1
Namibia and the SADC region – case studies.

Module Content:
Definition of statistics, descriptive and inferential statistics. Qualitative and quantitative data, primary versus secondary data. Sampling and sample size determinations, and replications. Presentation of data: tables, charts, graphs. Measures of central tendency: mean, mode, median. Measures of dispersion: standard deviation, coefficient of variation, standard error. Probability, Bayes' theorem, combinations and permutations, Binomial, Poisson, and Normal distributions, T-test and F- distribution mean comparisons, Analysis of variance, analysis assumptions. Single and multiple factor experiments, correlation and linear regression, transformations. Research process: research problem formulation, research objectives, hypothesis formulation. Basic experimental designs: completely randomized, randomized complete block, Latin square, Split plot.

Assessment strategies:
Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

IES3791 GEO-INFORMATICS

Module Title: **GEO-INFORMATICS**
Code: IES 3791
NQF level: 7
Contact hours: Lectures: 3 x 1hr/wk for 14 weeks (42 hrs);
Practicals: 1 x 2 hr alternate for 14 weeks (14 hrs)
NQF Credits: 12
Prerequisite: None
Compulsory/Elective: Compulsory
Semester offered: 2

Module Content:
Basic concepts, GIS data structures, processing and analysis techniques, basic cartography, map projections, introduction to GPS, basic aerial photograph interpretation. Use of GIS software. Use of GPS receiver. Display and manipulation of image files. Remote sensing for land use/land cover identification and vegetation monitoring.

Assessment strategies
Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

IEN3792 NATURE CONSERVATION

Module Title: **NATURE CONSERVATION**
Code: IEN 3792
NQF level: 7
Contact hours: Lectures: 3 x 1hr/wk for 14 weeks (42 hrs);
Practicals: 1 x 2 hr alternate for 14 weeks (14 hrs)
NQF Credits: 12
Prerequisite: None
Compulsory/Elective: Compulsory
Semester offered: 2

Module Content:
Principles of law with particular reference to environment, forestry and wildlife resources. Legal process governing environment and industrial pollution. Specific environmental acts and statutes dealing with environment, forestry and wildlife. Introduction to International environmental law and International Conventions; Policies: design, implementation, evaluation of policy impacts. Law enforcement in management of natural resources

Assessment strategies
Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

IES3702 COMMUNITY – BASED NATURAL RESOURCE MANAGEMENT

Module Title: **COMMUNITY-BASED NATURAL RESOURCE MANAGEMENT**
Code: IES 3702
NQF level: 7
Contact hours: Lectures: 3 x 1hr/wk for 14 weeks (28 hrs);
Practicals: 1 x 2 hr alternate for 14 weeks (14 hrs)
NQF Credits: 8
Prerequisite: None
Compulsory/Elective: Compulsory
Semester offered: 2

Module Content:
Rural development and livelihoods: concepts and principles. Principles of devolution, proprietorship, incentives, authority and responsibility over natural resources.Rural livelihood strategies.Local institutions for CBNRM; community forestry and conservancies: definition and approaches, aims and objectives,history, policy and strategies relevant to community forestry and conservancies. Technical and management alternatives to integrated forest management. Case studies on community forestry and conservancies.The role of governance, participation, communication and community capacity building on CBNRM.Natural resources monitoring and adaptive utilization.Enterprise development and benefit sharing.Management of conflicts over natural resources. Indigenous knowledge on conservation of natural resources

Assessment strategies
Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 2 hr paper)

AEC3712 AGRICULTURAL EXTENSION

Module Title: **AGRICULTURAL EXTENSION**
Code: AEC 3712
NQF level: 7
Contact hours: Lectures: 4 x 1hr/wk for 14 weeks (56 hrs);
Practicals: 1 x 1 Prac/W for 14 weeks (14 hrs)
NQF Credits: 16
Prerequisite: AAEC 3691 Rural Sociology
Compulsory/Elective: Compulsory
Semester offered: 2

Module Content:
The course explore Extension concepts; principles and theories; compare Modern and Traditional Extension; agricultural extension as adult learning; extension methods; definition and importance of program extension; philosophy and principles of program development in extension; Comparing agricultural extension approaches (FSRE); Science and Indigenous knowledge systems and participatory appraisal techniques ; Social change and innovation; Attributes of Innovations and their rate of adoptions; Elements in diffusion of Innovations; Motivational theories; Community participation and involvement in extension, PRA methodologies and techniques; Improving the organisation and management of extension; establishing and strengthening farmer's organisations.

Assessment Strategies
Continuous assessment 40% (minimum 2 tests and 1 assignment) Examination 60% (1 x 3 hour paper)

CSC3792 RESEARCH METHODS

Module Title: **RESEARCH METHODS**
Code: CSC 3792
NQF level: 7
Contact hours: 03 lecture hours/week for 14 weeks; 3 tutorial hours/practical hours alternate weeks for 14 weeks
NQF Credits: 12
Prerequisite: ACSC 3692: BIOSTATISTICS
Compulsory/Elective: Compulsory
Semester offered: 2

Module Content:
Students will be exposed to more advanced statistical concepts and research methods above those covered in Biostatistics. Comparison between parametric and non-parametric statistics. Non-parametric statistics: goodness of fit tests; tests of association, Chi Square tests; paired comparisons, Wilcoxon's tests; rank correlation; Multivariate methods: multiple regression, discriminant analysis, canonical analysis, multidimensional scaling, principal component analysis. Review of experimental designs with emphasis to livestock, crop and game animal experimentation. Review of procedures for implementing research projects and presentation of research results with emphasis to practical field situations and case studies. Introduction to Statistical Computer packages

Assessment strategies
Continuous Assessment: 40 % (minimum of 2 tests, 1 assignment, 7 practicals). Examination: 60% (01 x 02 hours paper)

E.6.7.4 FOURTH YEAR COURSES: FORESTRY SPECIALIZATION

FOR3810 RESEARCH PROJECT (FORESTRY)

Module Title: **RESEARCH PROJECT (FORESTRY)**
Code FOR 3810
NQF level 8
Contact hours Consultation: 1 x 1hr/wk for 28 weeks (28 hrs)

NQF Credits	32
Pre requisite	ACSC 3792: Research Methods
Compulsory/Elective	Compulsory
Semester offered	1&2

Module Content:
Senior undergraduate students carry out independent study of a current topic in natural resources and agriculture. The course include participation in meetings organized by the coordinator, work with a faculty advisor to develop a research project, formulate hypotheses, design and carry out preliminary experiments and collect data and test the hypotheses. Students will carry out independent library research, begin experimental work, prepare a written report and make a presentation to other students the proposal and final report. The student will submit a final report written following Guidelines for Scientific Writing.

Assessment strategies
Continuous assessment: 100% (research proposal write up and presentation of proposal in a seminar, presentation of empirical findings in a second seminar, and grading of the final report).

FOR3881 SILVICULTURE

Module Title:	**SILVICULTURE**
Code:	FOR 3881
NQF level	8
Contact hours	Lecturers: 3 x 1hr/wk for 14 weeks (42 hrs) Practicals: 1 x 2hr alternate for 14 weeks (14hrs)
NQF Credits	12
Pre requisite	IES 3681 Ecology; AIES 3682 Plant Physiology
Compulsory/Elective	Compulsory
Semester offered	1

Module content:
Definitions and relations with other disciplines.Forest stand dynamics.. Forest plantations: plantation forestry in Southern Africa: justification and historical perspective. Planning of plantation: site selection, choice of species and provenances.Nursery practice.Seed collection, processing, storage and treatment.Forest establishment: site preparation, establishment methods:natural regeneration, coppicing, planting – direct seeding and transplanting. Forest tree maintenance: post planting problems, fertilization, irrigation, weed control, protection, pruning and thinning.Applicable silvicultural systems.Silviculture of selected indigenous and exotic species.Theory and practice of tree improvements
Module Content:
The concept of disease, biotic and abiotic causes of plant diseases: Introduction to plant pathogenic organisms with special reference to forest pathogens; Principles of plant infection, disease establishment and spread; Major plant pathogens in Southern Africa, their etiologies and methods of control; Plant quarantine procedures in Southern Africa. Biology, ecology and control (cultural, chemical and biological) of major forest insect pests and stem/wood borers; Useful forest insects. Forest Fire Management: causes, prevention and suppression.
Assessment strategies
Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

FOR3891 FOREST PROTECTION

Module Title:	**FOREST PROTECTION**
Code:	FOR 3881
NQF level:	8
Contact hours	Lecturers: 3 x 1hr/wk for 14 weeks (42 hrs) Practicals: 1 x 2hr alternate for 14 weeks (14hrs)
NQF Credits	12
Pre requisite	None
Compulsory/Elective	Compulsory
Semester offered	1

Module Content:
The concept of disease, biotic and abiotic causes of plant diseases: Introduction to plant pathogenic organisms with special reference to forest pathogens; Principles of plant infection, disease establishment and spread; Major plant pathogens in Southern Africa, their etiologies and methods of control; Plant quarantine procedures in Southern Africa. Biology, ecology and control (cultural, chemical and biological) of major forest insect pests and stem/wood borers; Useful forest insects. Forest Fire Management: causes, prevention and suppression.
Assessment strategies
Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

FOR3881 FOREST MENURATION

Module Title:	**FOREST MENURATION**
Code:	FOR 3881
NQF level:	8
Contact hours	Lecturers: 3 x 1hr/wk for 14 weeks (42 hrs) Practicals: 1 x 2hr alternate for 14 weeks (14hrs)
NQF Credits	12
Pre requisite	None
Compulsory/Elective	Compulsory
Semester offered	1

Module Content:

Introduction; importance of forest mensuration, scientific basis of measurement, Measurement scales. Precision, Accuracy and biases in measurements. Measurements of tree parameters: diameter, height, tree form/taper/stem analysis and bark thickness. Tree age and growth determination.Volume calculation estimations.Wood weight estimates, density and moisture content.Estimation of stand parameters; basal area, volume, stocking, species diversity, structure and composition. Stand growth and increment: CAI, PAI, MAI. Site quality assessment.

Assessment strategies

Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

ACA3801 FIELD ATTACHMENT II

Module Title:	**FIELD ATTACHMENT II**
Code:	ACA3801
NQF level:	7
Contact hours:	Six weeks of Field Attachment
NQF Credits:	8
Pre requisite:	None
Compulsory/Elective:	Compulsory
Semester offered:	1 and 2

Module Content

Six weeks of field attachment; at the end of the third year first semester, students will be attached to industries and institutions dealing with environmental/natural resource management selected to ensure that the objectives of off-site training are attained. An attachment report and oral presentation will constitute the total assessment mark. Students will be visited during their attachment on-site to check on the efficiency of attachment.

Assessment strategies:

50 % report presentation at a seminar; 50 % Field report. Subject to satisfactory attendance and conduct during attachment.

GEC3881 PROJECT PLANNING AND MANAGEMENT

Module Title:	**PROJECT PLANNING AND MANAGEMENT**
Code:	GEC3881
NQF level:	8
Contact hours (14hrs)	Lecturers: 3 x 1hr/wk for 14 weeks (42 hrs) Practicals: 1 x 1hr Prac/W alternate for 14 weeks
NQF Credits	12
Pre requisite	AEC 3691 Principles of Micro-economics
Compulsory/Elective	Compulsory
Semester offered	1

Module Content:

The course includes topics such as: planning process, project cycle, logical framework, financial and economic analysis of project; Project feasibility and appraisal techniques (pay back period, the time value of money, Net Present Value, Benefit cost Ratio, and Internal Rate of Return), and sensitivity analysis; Project monitoring and evaluation, leadership, control, and the problems of identifying project costs and benefits and dealing with sustainability in project implementation

Assessment Strategies

Continuous assessment 60% (minimum 2 tests and 1 assignment) Examination 40% (1 x 3 hour paper)

FOR3882 FOREST INVENTORY

Module Title:	**FOREST INVENTORY**
Code:	FOR3882
NQF level:	8
Contact hours	Lecturers: 3 x 1hr/wk for 14 weeks (42 hrs) Practicals: 1 x 2hr alternate for 14 weeks (14hrs)
NQF Credits	12
Pre requisite	AFOF 3881 Forest Mensuration
Compulsory/Elective	Compulsory
Semester offered	2

Module Content:

Introduction to forest inventory.Purpose and planning of forest inventory. Sampling and samplings design;simple random sampling, systematic sampling, stratified sampling, cluster sampling, regression estimators, double and two stage sampling, point sampling. Types of forest inventory.Volume estimation of selected indigenous species.Assessment of other forest values.Data recording and processing in forest inventory.Recent developments in forest resource assessment.Introduction to remote sensing and its application in forest inventory.Interpretation of aerial photographs and forest classification.

Assessment strategies

Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

FOR3812 FOREST ECONOMICS AND MARKETING

Module Title:	**FOREST ECONOMICS AND MARKETING**
Code:	FOR3812
NQF level:	8
Contact hours	Lecturers: 4 x 1hr/wk for 14 weeks (56 hrs) Practicals: 1 x 2hr/wk for 14 weeks (28hrs)
NQF Credits	16

Pre requisite None
Compulsory/Elective Compulsory
Semester offered 2

Module Content:

Forest economic concepts, economics of resource conservation.Peculiarities of forestry: production period, interest rates. Costing of forest operations and their analysis.Methods of input costing – private versus social costs and private versus social benefits.Depreciation methods and determination of maintenance costs.Techniques of appraising forest investments: NPV, IRR, CBR, Subsidies, taxes, interest rates, risks and uncertainties. Economics of forestry operation: choice of species, spacing, economics of pruning, thinning, extraction..Forest valuation: stumpage appraisal, valuation of forest land, forest rotation. Principles of shadow pricing, economies and diseconomies of scale in forestry operations.Maximum sustainable yield and maximum economic yield. Work-study procedures... Economics of forest conservation. Techniques of evaluating protected areas: recreation sites, national parks, community forests, conservancies, etc. Principles of marketing, market research and promotion.

Assessment strategies

Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

FOR3892 FOREST MANAGEMENT

Module Title:	**FOREST MANAGEMENT**
Code:	FOR3892
NQF level:	8
Contact hours	Lecturers: 4 x 1hr/wk for 14 weeks (56 hrs) Practicals: 1 x 2hr/wk for 14 weeks (28hrs)
NQF Credits	12
Pre requisite	None
Compulsory/Elective	Compulsory
Semester offered	2

Module Content:

Scope of forest management. Theory and practice of normal forest. Estimation of growth and yield: growing site index equations, yield models, current yield and future yields. Sustained yield. Rotation, allowable cut, cutting cycle. Sustainable exploitation of woodlands (community forests, concession areas, private woodlands (private farms).Transportation of wood materials, Ergonomics and work safety.Forest management plans; development, implementation, monitoring and evaluation .Forest organisation in Namibia. Administration of forest enterprises; records, personnel management, programs of work.

Assessment strategies

Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

E.6.7.5 FOURTH YEAR COURSES: ENVIRONMENTAL SCIENCE SPECIALIZATION

ENV3810 RESEARCH PROJECT (FENVIRONMENTAL SCIENCE)

Module Title:	**RESEARCH PROJECT (ENVIRONMENTAL SCIENCE)**
Code:	ENV 3810
NQF level:	8
Contact hours:	Consultation: 1 x 1hr/wk for 28 weeks (28 hrs)
NQF Credits:	32
Pre requisite:	ACSC 3792: Research Methods
Compulsory/Elective:	Compulsory
Semester offered	1 and 2

Module Content:

Senior undergraduate students carry out independent study of a current topic in natural resources and agriculture. The course include participation in meetings organized by the coordinator, work with a faculty advisor to develop a research project, formulate hypotheses, design and carry out preliminary experiments and collect data and test the hypotheses. Students will carry out independent library research, begin experimental work, prepare a written report and make a presentation to other students the proposal and final report. The student will submit a final report written following Guidelines for Scientific Writing.

Assessment strategies

Continuous assessment: 100% (research proposal write up and presentation of proposal in a seminar, presentation of empirical findings in a second seminar, and grading of the final report).

ACA3801 FIELD ATTACHMENT II

Module Title:	**FIELD ATTACHMENT II**
Code:	ACA 3801
NQF level:	7
Contact hours:	Six weeks of Field Attachment
NQF Credits:	8
Pre requisite:	None
Compulsory/Elective:	Compulsory
Semester offered:	1 and 2

Module Content

Six weeks of field attachment; at the end of the third year first semester, students will be attached to industries and institutions dealing with environmental/natural resource management selected to ensure that the objectives of off-site training are attained. An attachment report and oral presentation will constitute the total assessment mark. Students will be visited during their attachment on-site to check on the efficiency of attachment.

Assessment strategies:

50 % report presentation at a seminar; 50 % Field report. Subject to satisfactory attendance and conduct during attachment.

Module Title:	**ENVIRONMENT AND DEVELOPMENT**
Code:	ENV 3881
NQF level:	8
Contact hours:	Lecturers: 3 x 1hr/wk for 14 weeks (42 hrs) Practicals: 1 x 2hr/wk for 14 weeks (28hrs)
NQF Credits:	12
Pre requisite:	None
Compulsory/Elective:	Compulsory
Semester offered:	1

Module Content:
Concepts of development and underdevelopment. Measurements of development. Links between environment and development. Sustainable development; concepts, principles (Triple bottom line) and approaches. National approaches and tools for sustainable development; EIA, state of the environment reporting, national strategy.
Assessment strategies
Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

ENV3891 ENVIRONMENTAL POPULATION AND CONTROL

Module Title:	**ENVIRONMENTAL POLLUTION AND CONTROL**
Code:	ENV 3891
NQF level:	8
Contact hours:	Lecturers: 3 x 1hr/wk for 14 weeks (42 hrs) Practicals: 1 x 2hr/wk for 14 weeks (14hrs)
NQF Credits:	12
Pre requisite:	None
Compulsory/Elective:	Compulsory
Semester offered:	1

Module Content:
The environment as a source and sink of resources and wastes. The concept of environmental degradation and pollution. The state of environmental pollution in Namibia. Classification of pollutants. Types of urban pollution. Measurement, dispersion and transportation of urban pollutants. Impact of urban pollution. Control strategies. Domestic/industrial water pollution; measurement, treatment and control. Agricultural pollutants and ecosystems. Use of environmentally friendly agrochemicals and fertilizers and alternative methods of pest control (biotechnology).
Assessment strategies
Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

ENV3801 WATERSHED MANAGEMENT

Module Title:	**WATERSHED MANAGEMENT**
Code:	ENV 3801
NQF level:	8
Contact hours:	Lecturers: 2 x 1hr/wk for 14 weeks (28 hrs) Practicals: 1 x 2hr/wk for 14 weeks (28 hrs)
NQF Credits:	8
Pre requisite:	None
Compulsory/Elective:	Compulsory
Semester offered:	1

Module Content:
The watershed as a unit of resource-oriented planning and development. Principles and objectives of watershed management .Physical description of watersheds. Relationships between land use conditions and water delivery characteristics of watersheds. Management and development of water sources in Namibia; perennial and ephemeral rivers, underground water, role of river basin authorities. Water harvesting. Watershed analysis including; techniques, collection of field data and sources of information.
Assessment strategies
Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

ENV3882 MANAGEMENT OF ARID AND SEMI-ARID LANDS

Module Title:	**MANAGEMENT OF ARID AND SEMI-ARID LANDS**
Code:	ENV 3882
NQF level:	8
Contact hours:	Lecturers: 3 x 1hr/wk for 14 weeks (42 hrs) Practicals: 1 x 2hr/wk for 14 weeks (28 hrs)
NQF Credits:	12
Pre requisite:	None
Compulsory/Elective:	Compulsory
Semester offered:	2

Module Content:
Characteristics of arid and semi-arid lands; concept of aridity, categories of drylands, characteristics of drylands, changes in drylands. Land use practices; traditional land use practices, crop production, pastoralism, game ranching, tourism and wildlife. Environmental management issues; desertification, land degradation, and prevention of land degradation.Types and methods of Interventions in management of drylands and their impacts.Reclamation and sustainable development of ASALS. Case studies in Namibia and the SADC region.
Assessment strategies
Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

ENP3882	ENVIRONMENTAL PLANNING AND MANAGEMENT

Module Title:	**ENVIRONMENTAL PLANNING AND MANAGEMENT**
Code:	ENP 3882
NQF level:	8
Contact hours:	Lecturers: 3 x 1hr/wk for 14 weeks (42 hrs) Practicals: 1 x 2hr/wk for 14 weeks (28 hrs)
NQF Credits:	12
Pre requisite:	None
Compulsory/Elective:	Compulsory
Semester offered:	2

Module Content:

Concepts of planning and management. Planning tools and processes: physical, human and institutional resources. Basic methods in planning and management of the environment. Environmental management plans: types, development, implementation, monitoring and evaluation.

Assessment strategies

Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

ENE3882	ENVIRONMENTAL IMPACT ASSESSMENT

Module Title:	**ENVIRONMENTAL IMPACT ASSESSMENT**
Code:	ENE 3882
NQF level:	8
Contact hours:	Lecturers: 3 x 1hr/wk for 14 weeks (42 hrs) Practicals: 1 x 2hr/wk for 14 weeks (28 hrs)
NQF Credits:	12
Pre requisite:	AIES 3782 NATURAL RESOURCE GOVERNANCE
Compulsory/Elective:	Compulsory
Semester offered:	2

Module Content:

Definitions: impact assessment, Environmental studies, Environmental Impacts of Human Activities on Natural Resources; impact on atmosphere, impact on water bodies, impact on wildlife, impact on forests; Environmental considerations in Physical planning. Impact identification, monitoring and mitigation; methods of identifying impacts, methods of monitoring environmental impacts, types of mitigation actions. Formal Environmental Impact Assessment: Origins and significance of formalized approach; historical context and rationale; major issues in formal EIA process; procedure of formal EIA process, common methodologies and examples o their application, Choosing an appropriate methodology. Policy and Framework in Namibia: monitoring and quality control, role of Departmental Affairs; EIA in Namibia.

Assessment strategies

Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3 hr paper)

ENE3882	ENVIRONMENTAL EDUCATION

Module Title:	**ENVIRONMENTAL EDUCATION**
Code:	ENE 3892
NQF level:	8
Contact hours:	Lecturers: 3 x 1hr/wk for 14 weeks (42 hrs) Practicals: 1 x 2hr/wk for 14 weeks (28 hrs)
NQF Credits:	12
Pre requisite:	None
Compulsory/Elective:	Compulsory
Semester offered:	2

Module Content:

General principles of environmental education. Environmental awareness and ethics. Environmental educational institutions: nature history museums, herbaria, zoos and botanical gardens, national parks, reserves. Methods of environmental education. Publicizing and advertising environmental issues. Environmental education in primary and secondary schools in Namibia. Environmental education in media. Environmental education at regional and global level

Assessment strategies

Continuous assessment: 40% (At least three assessments); Exam: 60% (1 x 3hr paper)

E.7 BSc (Geo-Information Science) (Honours) 13BGIS)

E.7.1 Purpose and Rationale for the Programme BSc (GIS) (Hons) (13BGIG Geography)

In the light of the application and proliferation of Geographic Information Systems (GIS) and Remote Sensing (RS) worldwide, this four-year undergraduate programme provides an academic education for students who intend to enter careers employing these novel and contemporary methods and techniques in spatial analysis. The programme deals with finding solutions to complex spatial problems and decision making dependent upon scientific analysis under the umbrella of GIS and RS. Cartography, computer science, information technology, project management, photogrammetry, planning and management science are integral part of this programme. From the second year level (NQF Level 6), this programme is designed to allow students to pursue a major in Geographic Information Science and Remote Sensing, and incorporating either Geography and Environmental Studies or Environmental Biology as a mainstay academic discipline. Courses comprising GIS and RS aim at developing student's skills and competency in computer programming, database management, spatial data capture, and data representation, GIS theory and GIS project development and implementation. This will respond to possible careers in various fields such Geography, Geomorphology, Climatology, Forestry, Marketing, Agronomy, Engineering, Transportation, Commerce, Urban and Regional Planning, Nature Conservation, Environmental Impact Assessment and Management as well as Marine and Coastal Management. Courses in communication and presentation offered in the Faculty constitute an indispensable complement to the programme, offering students to further communication and presentation skills for business environments, orally and in writing. In applying these tools, students have an option of employing them from a Geography and Environmental Studies or Environmental Biology perspective.

Programme Convenor: Associate Prof Martin Hipondoka (Tel. 206 3655 – E-mail: mhipondoka@unam.na)

Upon completion of the B.Sc. Degree in Geo-Information Science (Honours), students should be able to:

1. Apply geo-information science methods, technologies and applications for observation, analysis and interpretation of geographical information.
2. Demonstrate an understanding of new methods and techniques in Geo-Information Science.
3. Employ competence in developing tools for the acquisition, processing, transformation, analysis, modeling, storage and presentation of spatial data.
4. Design geo-information approach for responding to complex spatial problems and decision making.
5. Explain the scientific process and undertake scientific research in geo-information.
6. Demonstrate essential knowledge of the significance of spatial and temporal scales.
7. Appraise analytical thinking and conceptual skills as well as theoretical insights required for post-graduate studies.

E.7.2 The general admission for the B.Sc. Degree in Geo-Information Science (Honours):

A candidate must hold a valid Namibian Secondary Certificate (NSSC) (ordinary or higher) or a recognised equivalent qualification.

English is a compulsory subject and should normally have been obtained as a Second Language at NSSC (O level) with a minimum C symbol, or English as a First Language at NSSC (O level) with a minimum D symbol.

In addition to the above, admission to the B.Sc. (Geo-Information Science) programme of study requires at least a symbol C on NSSC or equivalent qualification in Mathematics and at least a symbol C on NSSC or equivalent qualification in Geography or Biology.

A candidate should obtain a minimum of 25 points on the UNAM Evaluation Point Scale in his/her five (5) best subjects (of which Mathematics and English must be included) to be admitted to undergraduate studies (Refer to the General Admission Criteria for Undergraduate Programmes in the General Information and Regulations Yearbook). Obtaining the minimum number of points, however, does not necessarily ensure admission. Admission is based on places available in courses and awarded on the basis of merit.

The Faculty reserves the right to interview students before admission.

Certain courses or subjects may require special written entry tests for screening candidates before admission is considered.

1.

The BSc. in Geo-information Science is a single major grounded in Geography and Environmental Studies or Environmental Biology as academic discipline and Computer Science minor. This implies that there are two streams within the programme. Stream A is anchored in Geography and Environmental Studies, whereas stream B is centered in Environmental Biology. The rational is that GIS and RS are spatial analysis tools, which are best utilized by specialists in related academic disciplines. In so doing, graduates are essentially grounded in a professional academic discipline, as opposed to becoming GIS and RS technicians.

At first year level students will take Geo-information Science and Geography and Environmental Studies or Environmental Biology courses. Selected courses from Computer Science, Statistics and Mathematics complement the program. The B.Sc. Degree in Geo-Information Science (Honours) consists of a total of 33 courses (Stream A 536 or Stream B 544 credits including UNAM Core credits), a field work and an excursion.

The overall structure can be schematically represented as follows:

Fourth				*3 courses*	*4 courses*	*128*
Third			*1 course*	*3 courses*	*4 courses*	*128*
Second			*2 courses*	*2 courses*	*4 courses*	*128*
First	*3 courses*	*2 courses*	*2 courses*	*2 courses*	*1 course*	*152/160*
Year Level	UNAM CORE CURRICULUM (48 credits)	MATHEMATICS AND STATISTICS (32 credits)	COMPUTER SCIENCE Minor Subject (80 credits)	GEOGRAPHY & ENVIRONMENTAL STUDIES / ENVIRONMENTAL BIOLOGY Major Subject 1 (160 credits)	GEO-INFORMATION SCIENCE Major Subject 2 (220 credits)	TOTAL CREDITS (536/544)

*** The University Core Curriculum consists of two (2) *Courses* and two (2) *half-Courses* (cf. C.4.3.1).**

E.7.3

To be awarded a Bachelor's Degree Honours by the Faculty, a student must pass a total of 33 *courses* (Stream A 536 or Stream B 544 credits).

Stream A: Geography and Environmental Studies

1.

Curriculum Compilation

Curriculum Compilation: Stream A – Geography and Environmental Studies

At first year level, students register for the University Core Curriculum courses and the required one (1) course **in Geo-information science** indicated below, plus two (2) *courses* in ***Geography and Environmental Studies***, two (2) courses in ***Computer Science*** and two (2) courses in ***Mathematics*** and ***Statistics***. The normal first year level curriculum of a student registered in the A-stream of the BSc (Geo-information) degree (Honours) programme will therefore consist of ten (10) *courses* (152 credits), compiled as follows:

Subject	*Courses*	Credits
University Core Curriculum	3	48
Geo-information Science	1	16
Geography and Environmental Studies at first year level	2	24
Computer Science	2	32
Mathematics and Statistics	2	32
Total	10	152

Curriculum Compilation

Throughout the academic year, the above courses require three (3) hours practical work per week: ***Practical 2*** All students registered for the following courses			
Semester	**Code**	**Course Title**	**Prerequisite**
1	GHE 3581	Fundamentals of Physical Geography	
2	GHE 3582	Fundamentals of Human Geography	
2	GIS 3532	Introduction to GIS	
1	GRS3531	Geo-scripting I	
1	MAT 3511	Basic Mathematics	
2	STS 3522	Introduction to Statistics	
2	GRS3552	Geo-scripting II	

2.

Admission Requirements

The Faculty's Student Registration and Academic Advancement Rules apply.

Curriculum Compilation

At second year level students continue with *Geo-information*, *Geography and Environmental Studies* and *Computer Science* subjects. The normal second year level curriculum of a student registered in the BSc Geo-information (Honours) degree programme will therefore consist of eight (8) *courses* (128 credits), compiled as follows:

Subject	*Courses*	Credits
Geography and Environmental Studies	3	32
Geo-information Science	5	96
Total	8	128

Curriculum

Throughout the academic year, the above courses require three (3) hours practical work per week: ***Practical 2***			
All students register for the following two (2) half courses below			
Semester	**Code**	**Course Title**	**Prerequisite**
1	GHE 3601	Geomorphology *(half course)*	HGHE 3581
1	GHE 3621	Climatology *(half course)*	HGHE 3581
Students further selects one (1) of the following three (3) half courses			
1	GHE 3661	Economic Geography *(half course)*	HGHE 3582
1	GHE 3641	Settlement Geography *(half course)*	HGHE 3582
2	GHE 3682	Social Geography *(half course)*	HGHE 3582
Students further selects one (1) of the following three (3) half courses			
2	GHE 3642	Biogeography *(half-course)*	HGHE 3511
2	GHE 3662	Pedology *(half-course)*	HGHE 3601
2	GPE 3622	Hydrology *(half-course)*	HGHE 3621
Students further register for the following Geo-information Science courses:			
1	GRS 3611	Remote Sensing I	HGIS 3532
2	GRS 3652	Remote Sesing II	HGRS 3611
1	GGS 3611	Spatial Statistics	SSTS 3522
2	GLS 3612	Land Administration and GIS	HGIS 3532
Students also register for the following Computer Science courses			
1	GIS3671	System Thinking	SCMP 3512
2	GCS 3612	Web GIS Development	UCLC 3509

3.

Admission Requirements
The Faculty's Student Registration and Academic Advancement Rules apply.

Curriculum Compilation
At third year level students continue with *Geo-information*, *Geography and Environmental Studies* and *Computer Science* subjects. The normal third year level curriculum of a student registered in the A-stream of the BSc Geo-information (Honours) degree programme will therefore consist of eight (8) *courses* (128 credits), compiled as follows:

Subject	*Courses*	Credits
Geography and Environmental Studies	3	32
Geo-information Science	5	96
Total	8	128

Curriculum

Throughout the academic year, the above courses require three (3) hours practical work per week: ***Practical 3.***			
All students register for the following courses:			
Semester	**Code**	**Course Title**	**Prerequisite**
1	GHE 3711	Environmental Studies	-
2	GHE 3752	Regional Geography	-
1	GRS 3751	Photogrammetry	HGRS 3652
2	GSM 3712	Spatial Modelling and Simulation	HGLS 3612
1	GSP 3711	Spatial Analysis and Planning I	
2	GDM 3712	Geodatabase Management	
2	GIS 3772	Advanced spatial analysis & Applications	HGSP 3711
2	GRS3702	Research Methodology in Geo-information Science	
Students also register for the following course:			
1	GCM 3711	Cartography and Mapping	HGLS 3612
All third year students register for the Excursion: **HGES 3799 Excursion**			

4.

Admission Requirements

1. Students are admitted to the fourth year level in the BSc Geo-information (Honours) degree programme only after they have passed at least twenty-five (25) *courses* (408 credits) at first, second and third year level.
2. Note the prerequisite below.

Curriculum Compilation
At fourth year level students continue with *Geo-information Science* as their major subject and enrol for three courses in *Geography and Environmental Studies* as their major application subject. The normal fourth year level curriculum of a student registered in the A-stream of the BSc Geo-information (Honours) degree programme will therefore consist of seven (7) *courses* (128 credits), compiled as follows:

Subject	*Courses*	Credits
Geography and Environmental Studies	3	48
GEO-INFORMATION SCIENCE	4	80
Total	7	128

Curriculum

All students register for the following two (2) *year-courses* in *Geography and Environmental Studies*:			
Semester	**Code**	**Course Title**	**Prerequisite**
1 & 2	GSP 3800	Environmental Management and Governance	-
1 & 2	GHE 3820	Themes in Advanced Geography and Environmental Studies	-
All students register for the following four (4) *courses* in *Geo-information Science*:			
1	GSP 3840	Spatial Analysis and Planning II	
1	GSO 3860	GIS and Local Planning	
1	GIS 3800	Project Management	
1 & 2	GPS 3810	Research Project in Geo-information Science	
All students register for the Internship course:			
1 & 2	GIS 3859	Geoinformation Work Integrated Learning (3 months)	

First Year Level

GHE 3582 Fundamentals of Physical Geography

Proposed NQF Level: 5 **Credits:** 12 **Contact Hours:** 3 hours/week over 14 weeks = 42 contact hours
Prerequisite:
Content: Students acquaint themselves with the essential foundations of Physical Geography, including common links to auxiliary disciplines and fields of study. The course presents structures, functions, processes and distributional patterns inherent in phenomena of 'natural' environments, relating to climate, geomorphology, hydrology, soils and vegetation. The content focuses on the interrelationship of geo-ecosystems, including the human factor. With particular reference to Namibian conditions, the course offers fundamental applications of concepts inherent in the functioning of the atmo-, litho-, hydro- and biosphere.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3582 Fundamentals of Human Geography

Proposed NQF Level: 5 **Credits:** 12 **Contact Hours:** 3 hours/week over 14 weeks = 42 contact hours
Prerequisite:
Content: Students acquaint themselves with foundations and concepts of Human Geography, including the subject's links to auxiliary disciplines. The course presents structures, functions, processes and distributional patterns inherent in phenomena of human environments. The content focuses on demographic features of population, rural and urban settlements and economic activities including tourism, land-use and infrastructure, regional diversity / similarity as well as politico-geographical perspectives relating to spatial development. Local to international references cover Namibia, the African continent and selected regions of the world. The course structure implies practical exercises / assignments, aiming at fostering application of knowledge, reflective thinking and practical skills.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GIS 3532 Introduction to GIS

Proposed NQF Level: 5 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: Univeristy, Faculty and Department Rules and Regulations apply
Content: This course introduces students to various basic concepts of geographical information systems, examining both local and global GIS trends. Topics includes: introduction to GPS, projection and distortions, basic and practical understanding of GIS concepts, techniques and real world applications; utilization of GIS in the larger context of geography and other applications; basic concepts of geography necessary to efficiently and accurately use GIS technology; GIS data models and concepts.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GRS 3531 Geoscripting I

Proposed NQF Level: 5 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Prerequisite:

Content: This is a beginner's course that introduces students to geospatial programming. In particular, the course will teach students how to program (e.g. in Python) for spatial data analysis. Since this is a beginner's course, students will first learn how to install and configure a programming language, implement basic syntax (addition, multiplication, division) in the interactive console; learn about concepts such as a variable (local and global), a loop (for and while), control flow statements (if, if else, break and stop) and how they are declared or implemented; learn about different data types (e.g. numeric, integer, logical, character) and operators (arithmetic operators, relational operators, assignment operators).Students will learn how and when to use these data types and operators. The course will also introduce students to a variety of data structures (vector, matrix, array, list, data frame), and when to use such data structures. Students will learn about the "function" concept in programming, and how to write and implement their own functions, and learn how to access eternal "functions" implemented in packages created by other people. Therefore, students will be taught about what a "package" is and how to install existing packages from external repository , and how to import such packages into their own programming environment. The course will then teach students how to read external data (tabular, vector and raster) using a programming language, how to plot the data, and also write such data to disk. Students will be taught how to save their codes as scripts, to allow reproducibility and repeatability. The course will conclude by introducing students to the best practices in programming, and the importance of such practices in code sharing and debugging. Throughout the course, students will be exposed to how to find programming related-answers to their programming issues, that may arise, from online resources (e.g Stack flow). An overview of programming languages which are commonly used to handle spatial data will be given, emphasising their similarities and/ or differences.

Assessment: Continuous assessment 50% : Examination 50% (1 x 3 hour examination paper)

MAT 3511 Basic Mathematics

Proposed NQF Level: 5 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: C in NSSC Mathematics

Content: Sets. What is a set? Set notation, equality of sets, subsets, characterization of equality via the subset relation, empty set, power sets, Venn diagrams, intersection, union, complement, de Morgan's laws, set difference, symmetric difference, proofs of *simple results* on set equality. Standard examples of sets: natural numbers, integers, rationals, real numbers. Absolute value, intervals in **R**. A bit about cardinality of sets (examples of finite, infinite, countable, uncountable sets). **Algebraic expressions.** Simplification, expansion, factorization, polynomials, remainder and factor theorem, quadratic polynomial. Binomial expansions, Pascal's triangle and the Binomial Theorem. Rational expressions, partial fractions. **Equations and inequalities.** Linear equations in one-variable, simultaneous linear equations, quadratic equations, simultaneous non-linear equations. Linear inequalities, non-linear inequalities. **Functions.** Definition of a function, domain, codomain, function notation, vertical-line test, image, pre-image, even function, odd function. **Trigonometry.** Trigonometric ratios, angle orientation in the *xy*-plane, graphs of trigonometric functions (circular functions), trigonometric identities, justifying (proving) equality of relatively simple trigonometric expressions. **Sequences.** Definition, notation, obtaining the general term in sequences, arithmetic sequences, geometric sequences, recursively defined

Assessment: Continuous assessment 50% : Examination 50% (1 x 3 hour examination paper)

GRS 3552 Geoscripting II

Proposed NQF Level: 5 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Co-rerequisite: GRS 3531 Geoscripting I

Content: This is an intermediate to advanced course that teaches students how to perform advanced spatial data analysis using a programming language (e.g. Python). The course assumes that students already have good working knowledge of programming, and are familiar with different types of spatial data (vector and raster). In the first part of the course, the focus will be on vector data analysis. In particular, students will learn how to assign coordinate system to vector data, and how to re-project the spatial data to new coordinate system. Next students will learn how to do data selection and subsetting based on attributes, and how to perform spatial data analysis that involve overlay analysis (e.g. cropping, erasing, spatial differences) and proximity analysis. Students will also learn how to perform spatial and attribute join, with an emphasis on one-to-one, one-to-many and many-to-one relationships. The second part of the course will focus on raster data analysis. Students will learn how to process raster data (e.g. satellite data). In particular students will learn how to assign, and re-project the raster data to new coordinate system, and how to perform image enhancement and image subsetting. Next Students will learn how to apply arithmetic operators to raster data, and how to perform image classification. Image classification will focus on both supervised and unsupervised classification. Next, students will be introduced to regression analysis using raster data; change detection, focusing on bi-temporal change detection approaches. Students will then be introduced to how to handle and process multi-temporal images; image classification and change detection. Challenges and opportunities related to handling and processing large raster datasets will be discussed. In the third part of this course, Students will learn how to combine vector and raster data to perform spatial analysis. Students will also learn how to vectorise raster data and rasterise vector data. Finally, students will learn how to make and export quality and publication-ready graphs and maps using a programming language.
Assessment: Continuous assessment 50% ; Examination 50% (1 x 3 hour examination paper)

STC 3522 Introduction to Statistics

Proposed NQF Level: 4 **Credits: 8** **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: C in NSSC Mathematics

Content: Definitions and scope of Statistics, Data and their measurements,Collection of data, Presentation of data,Numerical descriptive statistics
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

SECOND YEAR LEVEL

GHE 3601 Geomorphology (*half-course*)

Proposed NQF Level: 6 **Credits:** 8 **Contact Hours:** 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: None
Content: This course introduces students to a broad range of principles on geomorphologic landforms and processes that will enable them to identify, understand and describe their formation and distribution in Namibia and in southern Africa. The content focuses on processes such as weathering and mass wasting; and the creation of structural terrestrial, marine and aeolic landforms. Landscapes from Namibia and southern Africa exemplify the relevant types of landforms.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3621 Climatology(*half-course*)

Proposed NQF Level: 6 **Credits:** 16 **Contact Hours:** 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: None
Content:
The course investigates components, patterns, processes and functioning relating to phenomena of climatology such as air temperature; atmospheric moisture and precipitation; and on atmospheric pressure, motion and circulation.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3661 Economic Geography(*half-course*)

Proposed NQF Level: 6 **Credits:** 8 **Contact Hours:** 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: None
Content: Departing from the first year of fundamental topics in human geography, the course aims to broaden geographic knowledge, illustrate models, concepts and systems observed in economic geography and spatial patterns of economic land-use, distribution and development. The courses' objective means to enhance the comprehension of economic activity and its impact on local environments, national growth and global relationship.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3641 Settlement Geography (*half-course*)

Proposed NQF Level: 6 **Credits:** 8 **Contact Hours:** 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: None
Content: Departing from the first year of fundamental topics in human geography, the course aims to deepen geographic knowledge, illustrate models and concepts of central place, systems of settlement networks and development as nuclei of structural transformation and regional distribution. The course's objective means to enhance the comprehension of rural-urban migration affecting urbanisation and social change through settlement. crucial for individual and collective well-being effecting national growth and socio-cultural quality in housing rural-urban life.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3682 Social Geography (*half-course*)

Proposed NQF Level: 6 **Credits:** 8 **Contact Hours:** 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: None
Content: This course offers students concepts and approaches to essential thinking in Social Geography, broadening students' understanding of the interplay between society and space, including the interface experienced between society, crime and space. The content encompasses topics such as types of society and their structures; indicators defining disparities in livelihood; gender equality and social justice; as well as conditions of access to 2health and socio-economic development. Lectures present key concepts assumed to be "organising principles in societies", complemented by "culture-specific" perceptions pertaining to groups / classes of society and their regional distribution with an emphasis on Namibia.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3642 Biogeography (*half-course*)

Proposed NQF Level: 6 **Credits:** 8 **Contact Hours:** 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: None
Content: This course introduces students to the components, functions, processes, patterns and phenomena of Biogeography. Biogeography includes a broad range of topics including evolution, ecology, history of biogeography, biogeographical system, population ecology, distribution of single species and communities, dispersal and extinction, continental biogeography, conservation biogeography and biodiversity.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3662 Pedology (*half-course*)

Proposed NQF Level: 6 **Credits:** 8 **Contact Hours:** 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: None
Content: This course introduces students to soil spatial and temporal variability. Structure, chemical composition and properties of soil minerals and humic matter. Interactions between abiotic and soil biochemical processes. Soils in relation to ecosystems. Sampling, description, properties and designations of soil profiles and horizons. Diagnostic horizons and properties, and overall principles used in classification. Introduction to soil distribution and geography. Soil forming factors and soil forming processes with emphasis on acidification, mineral weathering, humification/mineralization. The course focuses also on global, regional and local soil classification.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GPE 3622 Hydrology (*half-course*)

Proposed NQF Level: 6 **Credits:** 8 **Contact Hours:** 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: None
Content: This course introduces students to the study of environmental hydrology and focuses on physical processes of water movement via precipitation, interception, evaporation, runoff, infiltration, groundwater flow, and streamflow.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GRS 3611 Remote Sensing I

Proposed NQF Level: 6 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite: HGRS 3612
Content: This course develops skills in Remote Sensing as a field of study, examining fundamental concepts; image and spectrum analysis and image interpretation. Its coverage includes principles of electro-magnetic radiation; energy/matter interaction; aerial photography and visual image interpretation; and image analysis principles/color theory.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper) (minimum 03 assessments, practical work)

GRS 3652 Remote Sensing II

Proposed NQF Level: 6 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite: HGRS 3611
Content: This course builds and develops broader and extensive understanding of remote sensing as a science and introduces students to various remote sensing problem solving tools and analysis. The focus of the course is multispectral RS Systems and Design; Digital Image Processing; VIS/NIR RS of Vegetation - Spectral/Temporal Characteristics, Indices, and Change Detection; VIS/NIR RS of Water, Soil, and Urban Areas; Thermal IR - Radiation Properties, Systems, and Applications; Microwave and LIDAR RS - Principles and Applications; and digital image analysis
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GGS 3611 Spatial Statistics

Proposed NQF Level: 6 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite:
Content: This course introduces students to basic statistics - univariate statistics, random variables & functions; bivariate & spacial statistics - spacial continuity, variogram models, geometric anisotropy; kriging - universal, bayesian, co-kriging, collocated co-kriging; sequential simulation, gaussian simulation; object techniques and when to apply geostatistics.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GLS 3612 Land Information Systems

Proposed NQF Level: 6 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite:
Content: This course introduces students to the importance of property register or systems of land information in a wider sense. It focuses also on institutional matters related to property registers such as the legislative framework and organizations involved; core principles related to the complexity of information such as public access, copyright, price setting; and management of registers relating to content, updating and security. Students will be expected to complete a practical training of structuring information into a property register in accordance with the Ministry of Lands and Resettlements. The second part of the course will focus on the science behind Geographical Information Systems with a focus on natural land resources complemented with a hands-on PC training; and the ability to perform an integrated spatial analysis on the basis of digital information. The course will also provide the basics of land valuation and land use planning by using remote sensing and GIS. The course allows students to get familiar with the architecture of GIS. Emphasis is given to the application of remote sensing and GIS tools for sustainable use of land resources with adequate capability and technical knowledge.

GIS 3671 System Thinking

Proposed NQF Level: 6 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite: None
Content: The challenges facing the world are complex, and often would require a system thinking perspective to solve them. This course will introduce students to system thinking perspective. What a system is, types of systems (natural and human-made) and their components and processes, what a system design is, and why certain systems (man-made systems) are designed the way they are structured; and why is a systemic thinking perspective is an important approach to finding well-informed solutions to problems within such systems.
Assessment criteria: Continuous assessment 40%, Examination 60%: (1 x 2 hours theory paper)

GCS 3612 Web GIS Development

Proposed NQF Level: 6 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite:
Content: This course is intended to teach fresh university students the principles behind web design and create a website. The following topical areas will be covered: Basic concepts of web site design using hypertext Markup language (HTML); Creating Web pages using Ms FrontPage or Macromedia Dream weaver; Introduce Web servers e.g. IIS and Apache; Creating a database with Mysql or Ms-Access; Concepts of Web page/database connectivity using Active Server Pages (ASP) and or PHP; Web Publishing techniques
Assessment criteria: Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Final Examinations 50% (1x 3 hour examination)

THIRD YEAR LEVEL

GHE 3711 Environmental Studies

Proposed NQF Level: 7 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: This course allows students to comprehend the paramount interaction of humans and their environment, the reasons for and consequences of this interrelationship and in many instances the ameliorating scenarios society can implement. Students should achieve this objective by integrating disciplines through the application of knowledge and research with oral and written presentations.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHE 3752 Regional Geography

Proposed NQF Level: 7 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: The course familiarises students with concepts of and approaches to Regional Geography and furthers students' comprehension of the complexity of the system "region", comprising regional structures and functions (politico-economic, socio-cultural). It reflects data in distinct regions, emphasising the interaction of local and external factors, forces and processes over distance and time in Namibia, Africa and other continents. The course incorporates aspects of regional disparity and explains regional development against the background of different paradigms and concepts of regional development.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper).

GRS 3751 Photogrammetry

Proposed NQF Level: 7 **Credits:** 16
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: Course Description:
This course offers the historical evolution of photogrammetry, including its dramatic evolution over the last 10 years. It further delves into various photogrammetric operations such as mathematical relationship between image and corresponding ground coordinates, as well as photogrammetric triangulation. Photogrammetric products are also covered at length. These products include Digital Elevation Models (DEM), Raster versus TIN representation, automatic DEM generation, generation of normalized image, orthophoto, polynomial rectification, differential rectification, image resampling techniques, true orthophoto, and stereo orthophotos. Photogrammetric project planning which encompasses photo scale selection, camera types, accuracy in planimetry and height, model area, ground control, and auxiliary data will also be treated.
Assessment criteria Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper)

GSM 3712 Spatial Modelling and Simulation

Proposed NQF Level: 7 **Credits:** 16
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: Course Description: This course invites students to:
This course invites participants to:

- Explore the nature of spatial modeling and simulation using scientific knowledge and techniques
- Understand the complexity of spatial modeling concepts, simulation courses and modeling applications
- Understand the complexity of computational modeling in relation to urban and regional land use development planning and management.
- Develop scientific artificial intelligence knowledge and understanding its application to spatial problems.
- Develop and enhance abilities to perform integrated vector-raster analysis and deriving new information, geometric modeling and strategic spatial intelligence modeling and planning.

Assessment criteria: Continuous Assessment 60% (Minimum of 3 assessments, practical work) Final Examinations 40% (1 x 3 hr paper)

GSP 3711 Spatial Analysis and Planning I

Proposed NQF Level: 7 **Credits:** 16
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: Course Description:
This course invites students to:

- Understand and explore the evolution of planning-changing role, concerns and products of planners in response to contextual change in Namibia.
- Understand the complexity of urban and regional planning,
- Gain insight on urban and regional systems, patterns, processes and policy issues in the local economic system, residential system and urban and rural transport systems.
- Explore and develop awareness on land use development models, land/property economics, and the social, political and economic context of urban and regional development planning.
- Assess and review urban and regional planning trends, planning challenges/problems using spatial technology techniques and tools in Southern African.

Assessment criteria Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper)

GDM 3712 Geodatabase Management

Proposed NQF Level: 7 **Credits:** 16
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content:
This course offers students with knowledge to explore the current status of spatial information technology; understand geo-database principles and architecture; familiarize themselves with concepts and architecture of database systems and database models and data modelling; design and develop spatial data and spatial database systems using Oracle. It further assist student to develop awareness in spatial data standards and metadata, spatial data sharing, data warehousing and database clearinghouse; develop spatial database implementation and project management strategies; develop awareness on user education and legal issues; user needs assessment and multi-user spatial solutions of spatial database systems; project management for spatial database

implementation; development of web-enabled spatial database systems; understand spatial data mining and decision support systems.
Assessment criteria: Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper)

GIS 3772 Advanced Spatial Analysis and Applications

Proposed NQF Level: 7 **Credits:** 16
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: Course Description:
This course offers students with knowledge, who wish to develop their knowledge of the principles and applications of geographical information systems (GIS) and remote sensing to solve real-world environmental problems. The programme focuses on collection, management and analysis of spatial data, and the development of technical and professional skills that can be used in the work-place or in research. Programme contents includes core topics such as ArcView/ArcGIS and ENVI software training; applications of very high spatial resolution satellite data; new remote sensing techniques including ground based and airborne LiDAR applications; spatial dataanalysis and visualization; digital terrain modeling, and a project.
Assessment criteria Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper).

GSM 3711 Cartography and Mapping

Proposed NQF Level: 7 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite: GLS 3612 Land Information Systems
Content:
This course covers the fundamental principles of cartography. It focuses on the knowledge and skills that are necessary to produce good quality maps within a digital environment. Special attention is given to the ways in which decisions in the cartographic process influence the geographic information communicated by the map. Cardinal amongst others are the importance of choosing the most appropriate projection, datum, scale, data, symbols, type, map technique, classification methods, map design process and map evaluation. The module structure implies practical exercises / assignments, aiming at fostering application of knowledge, reflective thinking and practical skills.
Assessment criteria: Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper

FOURTH YEAR LEVEL

GSP 3860 Environmental Management and Governance

Proposed NQF Level 8 **Credits:** 16 **Contact Hours:** 2hours / week for 28 weeks
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: The content demonstrates the need for conservation and environmental management. Discussions examine academic perspectives and build intellectual skills required in evaluation procedures such as Environmental and Social Impact Assessment. Practice-orientated assignments apply principles of Integrated Environmental Management (IEM). The module fosters the internalisation of environmental obligations, environmental auditing and environmental ethics needed for sustainable societies.
Assessment criteria : Continuous assessment: 60% (minimum 2 assignment and 3 exercises), Examination: 40% (01 x 3 hour paper).

GHE 3820 Themes in Advanced Geography and Environmental Studies

Proposed NQF Level: 8 **Credits:** 16 **Contact Hours:** 2 hours/week over 14 weeks = 56 contact hours
Prerequisite: Admission to the fourth year level
Content: The content focuses on themes in Physical and Human Geography as well as Environmental Studies that were recently or are currently researched or published by members of the Section, including professional members working in fields of applied geography, environmental management and/or tourism. This seminar-style course requires discussion and research assignments. Students choose their research assignments from specific topics announced during the first week of lecturing in the first semester of the relevant academic year.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GSP 3840 Spatial Analysis and Planning II

Proposed NQF Level: 8 **Credits:** 16 **Contact Hours:** 2 hours/week over 14 weeks = 56 contact hours
Prerequisite: Admission to the fourth year level
Content: An overview of historical development of urban and regional planning and as well as prominent theories and practices of urban and regional planning in Namibia and SADC. Explore the regulatory and legal planning law, integrated development planning, land management systems, environmental law, and law of professional practices in Namibia and Southern Africa. Develop insight in urban and regional design theory by examining contemporary theory and practices. Explore planning systems at national, regional and local governmental levels and systems such as representation and administration systems, local government finance and budgeting, negotiation and public participation, plan monitoring and evaluation.
Develop knowledge in best practices of urban and regional government good governance and management practices.Explore different models of urban and regional planning such as strategic vs. action planning.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GSO 3860 GIS and Local Planning

Proposed NQF Level 8 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: This course offers students the opportunity to appreciate GIS as a possible tool in improving local planning by simplifying continuously increasing planning information. It also deals with the development of a pool of arguments for planning decision making and the alternatives with better fit to the needs of the concerned local communities utilizing GIS.
Assessment criteria : Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper)

GIS 3800 Project Management

Proposed NQF Level 8 **Credits:** 16 **Contact Hours:** 2 hours / week for 28 weeks
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: This course focuses on GIS related project planning and management. The content covers the following aspects: project life cycle, project initiation and management, organizational behavior, spatial data infrastructure, information delivery, data sharing, budgeting and project costing and cost-benefit analyses of GIS. The course enables students to apply practical methodologies required to plan and manage efficiently a GIS project for public and private sector agencies.
Assessment criteria : Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper

GPS 3841 Geoinformation in Practice

Proposed NQF Level 8 **Credits:** 8 **Contact Hours:** one week fieldwork
Co-requisite: GPS 3810
Content: This is a field-based course that provide students with opportunity to acquire practical experience in spatial data collection,
Assessment criteria : Fieldwork participation: 100 %

GPS 3810 Research Project in Geo-Information Science

Proposed NQF Level 8 **Credits:** 32 **Contact Hours:** 2 hours per week over 28 weeks
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: This course represents a research component for which the student will select a research topic from one of the courses offered in the Biology Department or Geography and Environmental Studies section. A notable requirement is the use of GIS and/or RS as a tool that ought to be incorporated into the research study. Students will initially attend lectures in research methodology. After selection of a topic, each student will prepare and present a structured research proposal to her / his supervisor by the required deadline. Following approval of the research proposal, the student will conduct her / his research and write a research paper of between 10 000 and 15 000 words according to Departmental Guidelines and with the guidance of her / his supervisor. Students will be required to attend regular Departmental Research Seminars during the year where they will report on the progress of their research.
Assessment critieria: Continuous assessment 100% (Report (80%), presentation (20%))

GIS 3859 Geoinformation Work Integrated Learning

Proposed NQF Level 8 **Credits:** 16 **Contact Hours:** 200hrs
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: This course offers students opportunities to gain practical experience and to reflect on academic subjects within different settings outside the classroom. Students can earn between sixteen credits for an academic internship approved through the Faculty of Humanities and Social Sciences to any institutions/organization of a student choice. The internship has to be in the field of Geographical Information science.

E.7.4. B.Sc. Degree in Geo-Information Science (Honours) Programme - Stream B: Environmental Biology (13BGIE)
(13BGIE-for internal purpose only)

5.

Curriculum Compilation: Stream B – Environmental Biology
At first year level, students register for the University Core Curriculum courses and the required one (1) course **in Geo-information science** indicated below, plus two (2) *courses* in ***Environmental Biology*,** two (2) courses in ***Computer Science*** and two (2) courses in ***Mathematics*** and ***Statistics***. The normal first year level curriculum of a student registered in the B-stream of the BSc (Geo-information) degree (Honours) programme will therefore consist of ten (10) *courses* (160 credits), compiled as follows:

Subject	*Courses*	Credits
University Core Curriculum	3	48
Geo-information Science	3	48
Environmental Biology at first year level	2	32
Mathematics and Statistics	2	32
Total	10	160

Curriculum

All students registered for the following courses			
Semester	**Code**	**Course Title**	**Prerequisite**
1	BLG3511	Introduction to Biology	
2	BLG3512	Diversity of Life	
2	GIS 3532	Introduction to GIS	
1	GRS3531	Geo-scripting I	
1	MAT 3511	Basic Mathematics	
2	STS 3522	Introduction to Statistics	
2	GRS3552	Geo-scripting II	

6.

Admission Requirements
The Faculty's Student Registration and Academic Advancement Rules apply.

Curriculum Compilation
At second year level students continue with *Geo-information*, *Environmental Biology* and *Computer Science* subjects. The normal second year level curriculum of a student registered in the B-stream of the BSc Geo-information (Honours) degree programme will therefore consist of eight (8) *courses* (128 credits), compiled as follows:

Subject	*Courses*	Credits
Environmental Biology at second year level	2	32
GEO-INFORMATION SCIENCE	6	100
Total	8	132

Curriculum

All students register for the following compulsory courses below:			
Semester	**Code**	**Course Title**	**Prerequisite**
1	BL3631	Introduction to Ecology	BLG3511,BLG3512
2	BLG3612	Plant Form and Function	BLG3511, BLG3512
2	EBL3632	Ecological Field Techniques	BLG3511, BLG3512
Students further register for the following Geo-information Science			
1	GRS 3611	Remote Sensing I	HGIS 3532
2	GRS 3652	Remote Sensing II	HGRS 3611
1	GGS 3611	Spatial Statistics	SSTS 3522
2	GLS 3612	Land Administraion and GIS	HGIS 3532
Students also register for the following Computer Science courses			
1	GIS3671	System Thinking	
2	GCS 3612	Web GIS Development	

7.

Admission Requirements
The Faculty's Student Registration and Academic Advancement Rules apply.

Curriculum Compilation
At third year level students continue with *Geo-information*, *Environmental Biology* and *Computer Science* subjects. The normal third year level curriculum of a student registered in the B-stream of the BSc Geo-information (Honours) degree programme will therefore consist of eight (8) *courses* (128 credits), compiled as follows:

Subject	*Courses*	Credits
Environmental Biology	2	32
Geo-information Science	6	96
Total	8	128

Curriculum

All students register for the following courses:			
Semester	**Code**	**Course Title**	**Prerequisite**
1	EBL3721	Biosystematics	BLG 3612
1	GRS 3751	Photogrammetry	HGRS 3652
2	GSM 3712	Spatial Modelling and Simulation	HGLS 3612
1	GSP 3711	Spatial Analysis and Planning I	
2	GDM 3712	Geodatabase Management	
2	GIS 3772	Advanced spatial analysis & Applications	HGSP 3711
1	EBL3771	Conservation Biology and Biodiversity	EBL3631
2	EBL 3712	Ecosystem Ecology	EBL 3631
2	GRS3702	Research Methodology in Geo-information Science	
Students also register for the following Computer Science course:			
1	GCM 3711	Cartography and Mapping	HGLS 3612

8.

Admission Requirements

1. Students are admitted to the fourth year level in the BSc Geo-information (Honours) degree programme only after they have passed at least twenty-five (25) *courses* (416 credits) at first, second and third year level.
2. Note the prerequisite below.

Curriculum Compilation
At fourth year level students continue with *Geo-information Science* as their major subject and enrol for two courses in *Environmental Biology* as their major subject of application. The normal fourth year level curriculum of a student registered in the B-stream of the BSc Geo-information (Honours) degree programme will therefore consist of seven (7) *courses* (112 credits), compiled as follows:

Subject	*Courses*	Credits
Environmental Biology	1	16
GEO-INFORMATION SCIENCE	6	96
Total	7	112

Curriculum

All students register for the following compulsory *courses* below:			
Semester	**Code**	**Course Title**	**Prerequisite**
1	EBL3841	Integrated Natural Resources Management I	EBL3712 & EBL3771
1	GSP 3840	Spatial Analysis and Planning II	
1	GSO 3860	GIS and Local Planning	
1	GIS 3800	Project Management	
2	SEBL3852	Integrated Natural Resources Management II	
1	GPS3841	Geoinformation in Practice	Co-requiite :GPS3810
1 & 2	GPS 3810	Research Project in Geo-information Science	
1 & 2	GIS 3859	Geoinformation Work Integrated Learning (3 months)	

FIRST YEAR LEVEL

BLG 3511 Introduction to Biology

Proposed NQF Level: 5 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: NSSC, Biology C
Content: This is an introductory biology course that is designed to allow students to acquire a strong foundation into the biological sciences. The following topics will be covered: Basic techniques in biology such as microscopy, drawing, the scientific method and writing of scientific reports will be covered; Introduction to systems of classification (taxonomy and binomial nomenclature, including the five kingdoms and the three domain system); Organization of life (levels of organization): Molecule, organelle, cell, tissue, organ, organ system, organism, population, community, ecosystem, biosphere; Chemical basis of life: carbohydrates, proteins, nucleic acids, lipids and fats, water; Cell biology: prokaryotic and eukaryotic cells, ultra-structure of plant and animal cells, cytoskeleton, membrane structure and function, cell cycle, cell division; Genes, chromosomes, genomes, Mendelian genetics, extensions to Mendelian genetics, chromosome theory of inheritance, linkage and cross-over, recombination, sex determination; Early theories on evolution, Evolution by natural selection (microevolution vs macroevolution), phylogeny and evolutionary relationships in five kingdoms. (Concepts such as homology and analogy; body symmetry (radial, bilateral), cephalisation, body cavities: diploblastic, triploblastic (acoelomate and coelomate [deuterostomes and protostomes]) will be covered); Introduction to Ecology: Definitions, history, scales in ecology, application of ecology, energy flow, nutrient cycling, factors that influence the distribution of organisms (biotic and abiotic), biodiversity and the importance of conservation.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

BLG 3512 Diversity of Life

Proposed NQF Level: 5 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: NSSC, Biology C
Content: This course is designed to give students a detailed understanding of the diversity of life. This course gives students the broader appreciation of biodiversity in the different ecological habitats. The following topics will be covered: introduction to systems of classification, taxonomy and binomial nomenclature, including the five kingdom and the three domein system. This course will cover topics of viral, bacterial, fungal, algal and plant diversity. It then considers the characteristics and life cycles of the following important algae and plant groups: chlorophyta, phaeophyta, rhodophyta, chrysophyta, euglenophyta, pyrrophyta, cryptophyta, bryophytes, seedless vascular plants, gymnosperms, and the angiosperms. Protostomate phyla: Nemertea, Mollusca, Anellida, Arthropoda, Nematoda, Rotifera, Lophophorates, Onychophora. Deuterostomatephyla: Echinodermata, Hemichordata and Chordata (Subphyla: Urochordata, Cephalochordata and Vertebrata: Class Myxiniformes, Petromyzontiformes, Placoderms, Chodrichthyes, Actinopterygii, Actinistia, Dipnoi, Amphibia, Reptilia, Aves, Mammalia).

Examples from Namibia shall be used where possible and applicable. The course content shall be supplemented with appropriate weekly practical sessions in the laboratory and in the field.The course shall describe diagnostic characteristics of principle taxonomic categories for each phylum. Coverage of each phyla shall follow a phylogenetic approach as well as introduce broad ecological and physiological principles. Various aspects of reproduction and development shall be highlighted.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GIS 3532 Introduction to GIS

Proposed NQF Level: 5
Prerequisite: Univeristy, Faculty and Department Rules and Regulations applyCredits: 16**Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours

Content: This course introduces students to various basic concepts of geographical information systems, examining both local and global GIS trends. Topics includes: introduction to GPS, projection and distortions, basic and practical understanding of GIS concepts, techniques and real world applications; utilization of GIS in the larger context of geography and other applications; basic concepts of geography necessary to efficiently and accurately use GIS technology; GIS data models and concepts.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GRS 3531 Geoscripting I

Proposed NQF Level: 5 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: This is a beginner's course that introduces students to geospatial programming. In particular, the course will teach students how to program (e.g. in Python) for spatial data analysis. Since this is a beginner's course, students will first learn how to install and configure a programming language, implement basic syntax (addition, multiplication, division) in the interactive console; learn

about concepts such as a variable (local and global), a loop (for and while), control flow statements (if, if else, break and stop) and how they are declared or implemented; learn about different data types (e.g. numeric, integer, logical, character) and operators (arithmetic operators, relational operators, assignment operators).Students will learn how and when to use these data types and operators. The course will also introduce students to a variety of data structures (vector, matrix, array, list, data frame), and when to use such data structures. Students will learn about the "function" concept in programming, and how to write and implement their own functions, and learn how to access eternal "functions" implemented in packages created by other people. Therefore, students will be taught about what a "package" is and how to install existing packages from external repository , and how to import such packages into their own programming environment. The course will then teach students how to read external data (tabular, vector and raster) using a programming language, how to plot the data, and also write such data to disk. Students will be taught how to save their codes as scripts, to allow reproducibility and repeatability. The course will conclude by introducing students to the best practices in programming, and the importance of such practices in code sharing and debugging. Throughout the course, students will be exposed to how to find programming related-answers to their programming issues, that may arise, from online resources (e.g Stack flow). An overview of programming languages which are commonly used to handle spatial data will be given, emphasising their similarities and/ or differences.
Assessment: Continuous assessment 50% : Examination 50% (1 x 3 hour examination paper)

MAT 3511 Basic Mathematics

Proposed NQF Level: 5 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: C in NSSC Mathematics
Content: Sets. What is a set? Set notation, equality of sets, subsets, characterization of equality via the subset relation, empty set, power sets, Venn diagrams, intersection, union, complement, de Morgan's laws, set difference, symmetric difference, proofs of *simple results* on set equality. Standard examples of sets: natural numbers, integers, rationals, real numbers. Absolute value, intervals in **R**. A bit about cardinality of sets (examples of finite, infinite, countable, uncountable sets). **Algebraic expressions.** Simplification, expansion, factorization, polynomials, remainder and factor theorem, quadratic polynomial. Binomial expansions, Pascal's triangle and the Binomial Theorem. Rational expressions, partial fractions. **Equations and inequalities.** Linear equations in one-variable, simultaneous linear equations, quadratic equations, simultaneous non-linear equations. Linear inequalities, non-linear inequalities. **Functions.** Definition of a function, domain, codomain, function notation, vertical-line test, image, pre-image, even function, odd function. **Trigonometry.** Trigonometric ratios, angle orientation in the *xy*-plane, graphs of trigonometric functions (circular functions), trigonometric identities, justifying (proving) equality of relatively simple trigonometric expressions. **Sequences.** Definition, notation, obtaining the general term in sequences, arithmetic sequences, geometric sequences, recursively defined
Assessment: Continuous assessment 50% : Examination 50% (1 x 3 hour examination paper)

GRS 3552 Geoscripting II

Proposed NQF Level: 5 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Co-rerequisite: GRS 3531 Geoscripting I
Content: This is an intermediate to advanced course that teaches students how to perform advanced spatial data analysis using a programming language (e.g. Python). The course assumes that students already have good working knowledge of programming, and are familiar with different types of spatial data (vector and raster). In the first part of the course, the focus will be on vector data analysis. In particular, students will learn how to assign coordinate system to vector data, and how to re-project the spatial data to new coordinate system. Next students will learn how to do data selection and subsetting based on attributes, and how to perform spatial data analysis that involve overlay analysis (e.g. cropping, erasing, spatial differences) and proximity analysis. Students will also learn how to perform spatial and attribute join, with an emphasis on one-to-one, one-to-many and many-to-one relationships. The second part of the course will focus on raster data analysis. Students will learn how to process raster data (e.g. satellite data). In particular students will learn how to assign, and re-project the raster data to new coordinate system, and how to perform image enhancement and image subsetting. Next Students will learn how to apply arithmetic operators to raster data, and how to perform image classification. Image classification will focus on both supervised and unsupervised classification. Next, students will be introduced to regression analysis using raster data; change detection, focusing on bi-temporal change detection approaches. Students will then be introduced to how to handle and process multi-temporal images; image classification and change detection. Challenges and opportunities related to handling and processing large raster datasets will be discussed. In the third part of this course, Students will learn how to combine vector and raster data to perform spatial analysis. Students will also learn how to vectorise raster data and rasterise vector data. Finally, students will learn how to make and export quality and publication-ready graphs and maps using a programming language.
Assessment: Continuous assessment 50% ; Examination 50% (1 x 3 hour examination paper)

STS 3522 Introduction to Statistics

Proposed NQF Level: 5 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
ourse Content:
Definitions and scope of Statistics
- Statistics; descriptive, inferential.
- Variables: qualitative versus quantitative.

Data and their measurements
- Data types: primary versus secondary, categorical versus discrete, continuous.
- Sources of data: Population versus sample.
- Types of measurements: nominal, ordinal, interval, ratio scales.

Collection of data
- Reasons for sampling.
- Sampling techniques: probability versus non- probability sampling- advantages and disadvantages of each.
- Simple Random Sampling, Stratified Random Sampling, Systematic Sampling, cluster Sampling, Uses of random numbers. Convenience Sampling Purposive Sampling, Judgemental Sampling, Snowball Sampling.

Presentation of data
- tabular forms; frequency tables, cross-tabulations (two- variable)
- graphical methods; histograms, pie charts, bar charts, frequency polygons, stem- and- leaf plots, box- and-whiskers plot, ogives.

Numerical descriptive statistics

- Σ notation, Π notation.
- Measures of Central Tendency: mean, median, mode, quartiles, percentiles.
- Measures of Dispersion: variance, standard deviation, range, inter-quartile range, skewness, Kurtosis.
- Identifying outliers.
- Uses of scientific calculators for statistical manipulation limited to calculation of mean, standard deviation.
- Random number generation.

SECOND YEAR LEVEL

EBL 3631 Introduction to Ecology

Proposed NQF Level: 5 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Rre-requisite: BLG 3511 (Introduction to Biology) & (BLG 3512 Diversity of Life)
Content: Introduction to Ecology and the Biosphere: Definitions, history, scales in ecology, application of ecology, Components of the environment, the levels of organization in Ecology. Conditions and Resources: Environmental conditions, animals and their resources, plants and their resources, Introducing Population Ecology: Characteristics of populations- birth, death, movement, size, age structure, and sex ratios, density, dispersion, demographics, factors and processes influencing -, density dependent and independent factors, survivorship curves, life-tables, Life histories . Community Ecology: Patterns in conditions and resources, measuring biodiversity, biomes, biotic interactions, biotic and abiotic influence on community structure, . Ecosystem ecology: Primary productivity, flux of matter and trophic structures, food chains and food webs, biogeochemical cycles (hydrological-, carbon-, nitrogen-, and sulphur and phosphorous- cycles) and human influence on them. Conservation Ecology and Biodiversity: Definitions of biodiversity, distribution of the world's biodiversity; the current human caused mass extinction. History, concepts and definitions of Conservation Biology. Aquatic Ecology: The physical properties of water, Stream Ecology, Lake Ecology,
Assessment Criteria: Continuous Assessment (40%): Practicals 50% (no less than 5 assessed practicals), Theory 50% (3 tests, 1 assignment)

GRS 3611 Remote Sensing I

Proposed NQF Level: 6 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite: HGRS 3612
Content: This course develops skills in Remote Sensing as a field of study, examining fundamental concepts; image and spectrum analysis and image interpretation. Its coverage includes principles of electro-magnetic radiation; energy/matter interaction; aerial photography and visual image interpretation; and image analysis principles/color theory.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper) (minimum 03 assessments, practical work)

GRS 3652 Remote Sensing II

Proposed NQF Level: 6 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite: HGRS 3611
Content: This course builds and develops broader and extensive understanding of remote sensing as a science and introduces students to various remote sensing problem solving tools and analysis. The focus of the course is multispectral RS Systems and Design; Digital Image Processing; VIS/NIR RS of Vegetation - Spectral/Temporal Characteristics, Indices, and Change Detection; VIS/NIR RS of Water, Soil, and Urban Areas; Thermal IR - Radiation Properties, Systems, and Applications; Microwave and LIDAR RS - Principles and Applications; and digital image analysis
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GGS 3611 Spatial Statistics

Proposed NQF Level: 6 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite:
Content: This course introduces students to basic statistics - univariate statistics, random variables & functions; bivariate & spacial statistics - spacial continuity, variogram models, geometric anisotropy; kriging - universal, bayesian, co-kriging, collocated co-kriging; sequential simulation, gaussian simulation; object techniques and when to apply geostatistics.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GLS 3612 Land Administration and GIS

Proposed NQF Level: 6 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite:
Content: This course introduces students to the importance of property register or systems of land information in a wider sense. It focuses also on institutional matters related to property registers such as the legislative framework and organizations involved; core principles related to the complexity of information such as public access, copyright, price setting; and management of registers relating to content, updating and security. Students will be expected to complete a practical training of structuring information into a property register in accordance with the Ministry of Lands and Resettlements. The second part of the course will focus on the science behind Geographical Information Systems with a focus on natural land resources complemented with a hands-on PC training; and the ability to perform an integrated spatial analysis on the basis of digital information. The course will also provide the basics of land valuation and land use planning by using remote sensing and GIS. The course allows students to get familiar with the architecture of GIS. Emphasis is given to the application of remote sensing and GIS tools for sustainable use of land resources with adequate capability and technical knowledge.

GIS 3671 System Thinking

Proposed NQF Level: 6 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite: None
Content: The challenges facing the world are complex, and often would require a system thinking perspective to solve them. This course will introduce students to system thinking perspective. What a system is, types of systems (natural and human-made) and their components and processes, what a system design is, and why certain systems (man-made systems) are designed the way they

are structured; and why is a systemic thinking perspective is an important approach to finding well-informed solutions to problems within such systems.
Assessment criteria: Continuous assessment 40%, Examination 60%: (1 x 2 hours theory paper)

GCS 3612 Web GIS Development

Proposed NQF Level: 6 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite:
Content: This course is intended to teach fresh university students the principles behind web design and create a website. The following topical areas will
be covered: Basic concepts of web site design using hypertext Markup language (HTML); Creating Web pages using Ms FrontPage or Macromedia
Dream weaver; Introduce Web servers e.g. IIS and Apache; Creating a database with Mysql or Ms-Access; Concepts of Web page/database connectivity
using Active Server Pages (ASP) and or PHP; Web Publishing techniques
Assessment: Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Final Examinations 50% (1x 3 hour examination)

THIRD YEAR LEVEL

EBL 3721 Biosystematic I

Proposed NQF Level: 7 **Credits:** 8 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite: BLG 3612
Content: This module is designed to prepare candidates for biodiversity assessments -providing them with conceptual knowledge of Biosystematics as a science –and equipping them with the necessary skills required in the practice of taxonomy, including methods of collection, preservation and identification.The Practical component will emphasise practical approaches towards Biosystematics and taxonomy,
Assessment criteria: Continuous Assessment: Continuous assessment 40%: Practicals 35% (5 or more assessed practical work), Theory 45% (3 tests, 1 assignment), Specimen Collecting project (15%); seminar presentations (5%).
Examination 60%: (1 x 2 hours theory paper)

GRS 3751 Photogrammetry

Proposed NQF Level: 7 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: Course Description:
This course offers the historical evolution of photogrammetry, including its dramatic evolution over the last 10 years. It further delves into various photogrammetric operations such as mathematical relationship between image and corresponding ground coordinates, as well as photogrammetric triangulation. Photogrammetric products are also covered at length. These products include Digital Elevation Models (DEM), Raster versus TIN representation, automatic DEM generation, generation of normalized image, orthophoto, polynomial rectification, differential rectification, image resampling techniques, true orthophoto, and stereo orthophotos. Photogrammetric project planning which encompasses photo scale selection, camera types, accuracy in planimetry and height, model area, ground control, and auxiliary data will also be treated.
Assessment criteria Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper)

GSM 3712 Spatial Modelling and Simulation

Proposed NQF Level: 7 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: Course Description: This course invites students to:
This course invites participants to:
- Explore the nature of spatial modeling and simulation using scientific knowledge and techniques
- Understand the complexity of spatial modeling concepts, simulation courses and modeling applications
- Understand the complexity of computational modeling in relation to urban and regional land use development planning and management.
- Develop scientific artificial intelligence knowledge and understanding its application to spatial problems.
- Develop and enhance abilities to perform integrated vector-raster analysis and deriving new information, geometric modeling and strategic spatial intelligence modeling and planning.

Assessment: Continuous Assessment 60% (Minimum of 3 assessments, practical work) Final Examinations 40% (1 x 3 hr paper)

GSP 3711 Spatial Analysis and Planning I

Proposed NQF Level: 7 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: Course Description:
This course invites students to:
- Understand and explore the evolution of planning-changing role, concerns and products of planners in response to contextual change in Namibia.
- Understand the complexity of urban and regional planning,
- Gain insight on urban and regional systems, patterns, processes and policy issues in the local economic system, residential system and urban and rural transport systems.
- Explore and develop awareness on land use development models, land/property economics, and the social, political and economic context of urban and regional development planning.
- Assess and review urban and regional planning trends, planning challenges/problems using spatial technology techniques and tools in Southern African.

Assessment: Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper)

GDM 3712 Geodatabase Management

Proposed NQF Level: 7 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks

Prerequisite: University, Facultyand Department Rules and Regulations apply

Content:

This course offers students with knowledge to explore the current status of spatial information technology; understand geo-database principles and architecture; familiarize themselves with concepts and architecture of database systems and database models and data modelling; design and develop spatial data and spatial database systems using Oracle. It further assist student to develop awareness in spatial data standards and metadata, spatial data sharing, data warehousing and database clearinghouse; develop spatial database implementation and project management strategies; develop awareness on user education and legal issues; user needs assessment and multi-user spatial solutions of spatial database systems; project management for spatial database implementation; development of web-enabled spatial database systems; understand spatial data mining and decision support systems.

Assessment: Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper)

GIS 3772 Advanced Spatial Analysis & Applications

Proposed NQF Level: 7 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks

Prerequisite: University, Facultyand Department Rules and Regulations apply

Content: Course Description:

This course offers students with knowledge, who wish to develop their knowledge of the principles and applications of geographical information systems (GIS) and remote sensing to solve real-world environmental problems. The programme focuses on collection, management and analysis of spatial data, and the development of technical and professional skills that can be used in the work-place or in research. Programme contents includes core topics such as ArcView/ArcGIS and ENVI software training; applications of very high spatial resolution satellite data; new remote sensing techniques including ground based and airborne LiDAR applications; spatial dataanalysis and visualization; digital terrain modeling, and a project.

Assessment: Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper)

GSM 3711 Cartography and Mapping

Proposed NQF Level: 7 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks

Prerequisite: GLS 3612 Land Information Systems

Content:

This course covers the fundamental principles of cartography. It focuses on the knowledge and skills that are necessary to produce good quality maps within a digital environment. Special attention is given to the ways in which decisions in the cartographic process influence the geographic information communicated by the map. Cardinal amongst others are the importance of choosing the most appropriate projection, datum, scale, data, symbols, type, map technique, classification methods, map design process and map evaluation. The module structure implies practical exercises / assignments, aiming at fostering application of knowledge, reflective thinking and practical skills.

Assessment: Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper

EBL 3771 Conservation Biology and Biodiversity

Proposed NQF Level: 7 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks

Prerequisite: EBL 3631

Content: This module demonstrates how humans impact on ecosystems and expose students to issues of Conservation and biodiversity. Students will be made aware of the integrated nature of ecosystems and the need for sustainable utilization of natural resources

Assessment : Continuous Assessment 40%: Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment) Examination 60%: 1 x 3 hr theory paper

EBL 3712 Ecosystem Ecology

Proposed NQF Level: 7 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks

Prerequisite: EBL 3631

Content: This module will provide an insight into the structure and function of nature at the community, ecosystem and biome levels of biological organization. Students will be introduced to the science of ecosystem ecology, a study of communities of plants and animals and how they interact with each other and their physical environment. Applied aspects of ecology such as deforestation and desertification will also form an important component of the module.

Assessment: Continuous Assessment 40%: Practicals (at least 10 assessed practicals), Theory (2 tests, 1 assignment) Examination 60%: 1 x 3 hr theory paper

GSP 3840 Spatial Analysis and Planning II

Proposed NQF Level: 8 **Credits:** 16 **Contact Hours:** 2 hours/week over 14 weeks = 56 contact hours

Prerequisite: Admission to the fourth year level

Content: An overview of historical development of urban and regional planning and as well as prominent theories and practices of urban and regional planning in Namibia and SADC. Explore the regulatory and legal planning law, integrated development planning, land management systems, environmental law, and law of professional practices in Namibia and Southern Africa. Develop insight in urban and regional design theory by examining contemporary theory and practices. Explore planning systems at national, regional and local governmental levels and systems such as representation and administration systems, local government finance and budgeting, negotiation and public participation, plan monitoring and evaluation.

Develop knowledge in best practices of urban and regional government good governance and management practices.Explore different models of urban and regional planning such as strategic vs. action planning.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

EBL 3841 Integrated natural resource management I

Proposed NQF Level: 8 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: SEBL3712, SEBL3771
Co-requisite:
Content: Introduction and Overview (Definitions of management, integrated management, sustainable management, natural resources; Objectives of natural resources management, Concept of adaptive management and adaptive decision-making in natural resources management); Classification of natural resources (stock, flow, renewable, non-renewable, perpetual, exhaustible, non-exhaustible); Measures of stock resource availability (resource base, proven reserves, conditional, reserves, hypothetical resources, speculative resources, ultimately recoverable resources); Measures of flow resource availability (maximum resource potential, sustainable capacity, absorptive capacity, carrying capacity); Causes and consequences of resource scarcity; Indigenous knowledge systems (IKS) in natural resource management (definitions, importance, examples). Biodiversity management: Wildlife/Game management in Parks and Ranches (management for tourism and harvest, manipulation of animal numbers, concept of maximum sustained yield (MSY) in wildlife management, International and national conventions/legislation/regulations related to wildlife management and trade); Management of forest/woodland resources (definitions, types of forest management (by the State, by local communities, co-management, multi-stakeholder management, non-timber forest products); Fisheries resources management (Concept of a stock, multi-species fishery management, MSY concept in fisheries management, integrated fisheries management); Integrated water resources management (IWRM) (evolution of water management, Principles of IWRM; Integrated coastal zone management (ICZM) (the need for ICZM, Principles of ICZM). Natural resource economics (economic systems & valuation techniques).
Assessment: Continuous assessment 50% : Examination 50% (1 x 3 hour examination paper)

EBL 3852 Integrated natural resource management II

Proposed NQF Level: 8 **Credits:** 16 **Contact Hours:** 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: SEBL3712, SEBL3771
Co-requisite: EBL 3841
Content: This course prepares students for careers in management of natural resources. The following topics will be covered: Wildlife/Game management in Parks and Ranches (management for tourism and harvest, manipulation of animal numbers, concept of maximum sustained yield (MSY) in wildlife management, International and national conventions/legislation/regulations related to wildlife management and trade); Management of forest/woodland resources (definitions, types of forest management (by the State, by local communities, co-management, multi-stakeholder management, non-timber forest products); Fisheries resources management (Concept of a stock, multi-species fishery management, MSY concept in fisheries management, integrated fisheries management); Integrated water resources management (IWRM) (evolution of water management, Principles of IWRM, National and International conventions/regulations/laws/policies on IWRM); Integrated coastal zone management (ICZM) (the need for ICZM, Principles of ICZM; National and International conventions/regulations/laws/policies on ICZM); Environmental management (Principles of environmental management, National and International conventions/treaties/policies on environmental management, Environmental management systems (ISO 14000 series standards); Integrated Environmental Management (Integrated Environmental Management Systems (IMS), Principles of IMS, Environmental impact assessment (EIA), Environmental Audits, Project management); Waste management; Basics of Natural resource economics (economic systems, cost-benefit analysis, placing money on non-market goods, valuation approaches/methods); Basics of Ecological Economics (definitions, outline of some current problems in society, economics and ecology, fundamental principles of ecological economics, introduction to modeling ecological–economic systems).
Assessment: Continuous assessment 40% : Examination 60% (1 x 3 hour examination paper)

GSO 3860 GIS and Local Planning

Proposed NQF Level 8 **Credits:** 16 **Contact Hours:** 4 hours / week for 14 weeks
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: This course offers students the opportunity to appreciate GIS as a possible tool in improving local planning by simplifying continuously increasing planning information. It also deals with the development of a pool of arguments for planning decision making and the alternatives with better fit to the needs of the concerned local communities utilizing GIS.
Assessment : Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper)

GIS 3800 Project Management

Proposed NQF Level 8 **Credits:** 16 **Contact Hours:** 2 hours / week for 28 weeks
Prerequisite: University, Facultyand Department Rules and Regulations apply
Content: This course focuses on GIS related project planning and management. The content covers the following aspects: project life cycle, project initiation and management, organizational behavior, spatial data infrastructure, information delivery, data sharing, budgeting and project costing and cost-benefit analyses of GIS. The course enables students to apply practical methodologies required to plan and manage efficiently a GIS project for public and private sector agencies.
Assessment : Continuous assessment 60 % (minimum 03 assessments, practical work) Examination 40 % (01 x 03 hours paper

GPS 3841 Geoinformation in Practice

Proposed NQF Level 8 **Credits:** 8 **Contact Hours:** one week fieldwork
Co-requisite: GPS 3810
Content: This is a field-based course that provide students with opportunity to acquire practical experience in spatial data collection,
Assessment criteria : Fieldwork participation: 100 %

GPS 3810 Research Project in Geo-Information Science

Proposed NQF Level 8 **Credits:** 32 **Contact Hours:** 2 hours per week over 28 weeks
Prerequisite: University, Facultyand Department Rules and Regulations apply

Content: This course represents a research component for which the student will select a research topic from one of the courses offered in the Biology Department or Geography and Environmental Studies section. A notable requirement is the use of GIS and/or RS as a tool that ought to be incorporated into the research study. Students will initially attend lectures in research methodology. After selection of a topic, each student will prepare and present a structured research proposal to her / his supervisor by the required deadline. Following approval of the research proposal, the student will conduct her / his research and write a research paper of between 10 000 and 15 000 words according to Departmental Guidelines and with the guidance of her / his supervisor. Students will be required to attend regular Departmental Research Seminars during the year where they will report on the progress of their research.
Assessment: Continuous assessment 100% (Report (80%), presentation (20%))

GIS 3859 Geoinformation Work Integrated Learning

Proposed NQF Level 8 **Credits:** 16 **Contact Hours:** 200hrs
Prerequisite: University, Facultyand Department Rules and Regulations apply
CONTENT: THIS COURSE OFFERS STUDENTS OPPORTUNITIES TO GAIN PRACTICAL EXPERIENCE AND TO REFLECT ON ACADEMIC SUBJECTS WITHIN DIFFERENT SETTINGS OUTSIDE THE CLASSROOM. STUDENTS CAN EARN BETWEEN SIXTEEN CREDITS FOR AN ACADEMIC INTERNSHIP APPROVED THROUGH THE FACULTY OF HUMANITIES AND SOCIAL SCIENCES TO ANY INSTITUTIONS/ORGANIZATION OF A STUDENT CHOICE. THE INTERNSHIP HAS TO BE IN THE FIELD OF GEOGRAPHICAL INFORMATION SCIENCE.

F. DEPARTMENT OF COMPUTING, MATHEMATICAL & STATISTICAL SCIENCES

F1. COMPUTING

F.2. DIPLOMA IN COMPUTER SCIENCE (22DCMP)

F.2.1. REGULATION PERTAINING TO DIPLOMA STUDIES

F.2.1.1. ADMISSION REQUIREMENTS

To qualify for admission to the undergraduate Diploma at the University of Namibia, a candidate must hold a valid Namibian Senior Secondary Certificate (NSSC) (ordinary or higher) or a recognized equivalent qualification, obtained in not more than two examination sittings with a minimum of 22 points in five subjects on the UNAM Evaluation Scale. English is a compulsory subject and should have been obtained on a First or second Language Ordinary Level with symbol D or higher. In addition to the University requirements, candidates wishing to register for a Diploma in Computer Science also need to have obtained a minimum of a D-symbol in NSSC Mathematics, or equivalent qualification. Obtaining the minimum number of points, however, does not necessarily ensure admission. Admission is based on places available in courses, subjects and programmes and is awarded on the basis of merit. The Faculty reserves the right to subject the candidate to additional selection procedures.
Admission can also be considered for persons who qualify through the Mature Age Entry Scheme upon successful completion of the relevant examinations as set out in the General Information and Regulations Prospectus. A special application form is available for this purpose. Such candidates may also be required to pass a Faculty entry test before admission is granted.

F.2.1.2. DURATION OF STUDY

The Diploma in Computer Science cannot be completed in less than two (2) years. All students registering for this qualification must complete their studies within three (3) years of full-time study, unless special permission is granted for this period to be exceeded.

F.2.1.3. MODE OF DELIVERY

The Diploma in Computer Science is a full-time programme. The programme comprises of a total credit of 256 and it is at Namibian Qualification Framework (NQF) level 5. The year 1 courses are at NQF level 4 whereas the year 2 courses are at NQF level 5.

F.2.1.4. EXAMINATION REGULATIONS

A candidate will be eligible to write the examination if he/she has obtained the required continuous assessment mark of 40% in a particular course. Examination will be administered at the end of each semester. For detailed examination and promotion rules see the General Prospectus: Information, Regulations and Fees.

F.2.1.5. MINIMUM REQUIREMENTS FOR RE-ADMISSION

To be re-admitted to the Diploma programme, a student must have passed the minimum number of courses required as indicated below:

- 3 courses (equivalent to 48 credits) by the end of the first year; 2 of these courses (equivalent to 32 credits) must be non-core.
- 8 full courses (equivalent of 128 credits) by the end of the second year

F.2.1.6. ADVANCEMENT AND PROGRESSION RULES

A student advances to the second academic year of study when at least 6 courses (96 credits) of the curriculum for a first year have been passed.

F.2.1.7. MAXIMUM NUMBER OF COURSES PER YEAR

Students can register for all first year courses and thereafter, no more than 10 courses in any academic year.

F.2.1.8. ARTICULATION ROUTE

Successful completion of this diploma serves as an entry point to the Bachelor of Science in Information Technology Honours and for the Bachelor of Science in Computer Science Honours. Students who successfully complete the Diploma in Computer Science will be exempted from the following courses in the first year of study:

SUBJECT PASSED	COURSE TO BE EXEMPTED
CLC3509 Computer Literacy	CLC3509 Computer Literacy
CMP2571 Programming I	CMP3511 Programming Fundamentals I
CMP2572 Programming II	CMP3512 Programming Fundamentals II
CMP2552 Network Administration	CIT3521 Fundamentals of Information Technology I
LEG2410 English for General Communication	LCE3419 English Communication & Study Skills
CSI3580 Contemporary Social Issues	CSI3580 Contemporary Social Issues

F.2.1.9. QUALIFICATION: DIPLOMA IN COMPUTER SCIENCE (22DCMP)- OSHAKATI CAMPUS

YEAR 1

CODE	COURSE NAME	NQF Level	CREDITS	PREREQUISITES	COREQUISITES
Year 1 Semester 1					
CLC3509	Computer Literacy	4	8		None
CMP2411	Introduction to Computer Systems	4	16		None
CMP2421	Principles of Information Systems	4	8		None
STD2431	Basics of Statistics	4	16		None
Year 1 Semester 2					
MAT2432	Introduction to Mathematics	4	8		None
CMP2412	Programming Principles	4	16		CMP2421
CMP2432	Information Systems Management	4	16		CMP2421
CSI3580	Contemporary Social Issues	4	8		None
LEG2410	English for General Communication	4	32		None
Total Credits			128		

YEAR 2

CODE	COURSE NAME	NQL Level	CREDITS	PREREQUISITES	COREQUISITES
Year 2 Semester 1					
CMP2511	Fundamentals of Database Systems	5	16	CMP2411	None
CMP2531	Fundamentals of System Administration	5	16	CMP2411	None
CMP2551	Fundamentals of Computer Networks	5	16	CMP2411	None
CMP2571	Programming I	5	16	CMP2412	None
Year 2 Semester 2					
CMP2512	Database management	5	16	CMP2411	CMP2511
CMP2532	System Administration	5	16	CMP2411	CMP2531
CMP2552	Network Administration	5	16	CMP2411	CMP2551
CMP2572	Programming II	5	16	CMP2412	CMP2571
Total Credits			128		

F.2.1.10. DIPLOMA IN COMPUTER SCIENCE COURSE DESCRIPTIONS

FIRST YEAR COURSES

CMP2411 INTRODUCTION TO COMPUTER SYSTEMS

Course Title: **INTRODUCTION TO COMPUTER SYSTEMS**
Course Code: CMP2411
NQF Level: 4
Contact Hours: 4 lectures + a 3-hour practical session per week for one semester
NQF Credits: 16
Course Assessment: Continuous assessment (at least 2 tests and 1 assignment) 50%; 1 x 3 hours Examination 50%
Prerequisite None

Course description: This course introduces general computers systems principles and covers topics such as: History of Computers; Parts of a computer; Input and Output devices; Operating Systems; File Systems; Types of Storage; Memory, Memory: memory units, memory hierarchy, memory allocation, virtual memory, signals, input and output; Number System: Binary, Decimal, Octal, Hexadecimal, Floating-point number representation and arithmetic; Introduction to machine programs; Information processing cycle. Arithmetic unit: Carry look-ahead adders, Subtractors, and shifters; Logic unit; Combinational and sequential multipliers and dividers; Basic construction of a PC.

CMP2421 PRINCIPLES OF INFORMATION SYSTEMS

Course Title: **PRINCIPLES OF INFORMATION SYSTEMS**
Course Code CMP 2421
NQF Level 5
Contact Hours 2 lectures + one practical session every second week for one semester
NQF Credits 8
Course Assessment: Continuous assessment (at least 2 tests and 1 assignment) 50%; 1 x 2 hours Examination 50%
Prerequisite None

Course description: This course introduces the basic components of information systems: Hardware, Software, Data, Networks, Facilities, Personnel, Services, Partners. It covers the following topics: Information systems in organizations; Cost/value information, Quality of information, Competitive advantage of information, Information Systems and organizational strategy; The Internet and WWW : E-business, Intranets, Internet, extranets, Web 2.0; Technologies: e.g., wikis, tags, blogs, netcasts, self-publishing; New forms of collaboration: social networking, virtual teams, virtual marketing, crowd-sourcing; Security of information systems: Threats to information systems, Technology-based safeguards, Human-based safeguards, Information systems security planning and management; Need for Business intelligence: Organizational decision making, functions, and levels, Executive, managerial, and operational levels, Systems to support organizational functions and decision making; Information systems ethics and crime: Information privacy, accuracy, property, and accessibility, Computer crime, Cyberwar / cyber terrorism

CMP2412 PROGRAMMING PRINCIPLES

Course Title:	**PROGRAMMING PRINCIPLES**
Course Code	CMP2412
NQF Level	4
Contact Hours	4 lectures plus a 3 hour practical session per week for one semester
NQF Credits	16
Course Assessment:	Continuous assessment (at least 2 tests and 1 assignments) 50%; 1 x 3 hours Examination 50%
Co-requisite	CMP2421 Principles of Information Systems

Course Description: This course introduces the principles of programming and covers the following topics: Problem Solving Strategies, Program Development Steps: Planning Phase, Analysis, Design, Implementation, Testing, Maintenance. Programming Constructs: Primitive Data Types, Variables, Expressions& Assignment, Strings and String Processing, Arrays, Records, Files, Scope and Lifetime Of Variables, Strategies For Choosing The Right Data Structures. Conditional and Iteration Constructs: The Selection Structure, Comparison Operators, Logical Operators, Nested Selection Structures, The Case Selection Structure, The Repetition Structure, The For…Next Statement, The Do…Loop Statement.

CMP2432 INFORMATION SYSTEMS MANAGEMENT

Course Title:	**INFORMATION SYSTEMS MANAGEMENT**
Course Code	CMP2432
NQF	5
Contact Hours	4 lectures + a 3-hour practical session per week for one semester
NQF Credits	16
Course Assessment:	Continuous assessment (at least 2 tests and 1 assignments) 50%; 1 x 3 hours Examination 50%
Co-requisite	CMP2421 Principles of Information Systems

Course Description: This course introduces students to Project Management basics, and covert the following topics: Managing Project Scope, Estimating Project Time, Developing a Project Schedule, Analysing the Cost of a project, Measuring the Project Quality, Managing Human Resources, Analysis Risks, Integrating Project Workflows.

SECOND YEAR COURSES

CMP2551 FUNDAMENTALS OF COMPUTER NETWORKS

Course Title:	**FUNDAMENTALS OF COMPUTER NETWORKS**
Course Code	CMP2551
NQF Level	5
Contact Hours	4 lectures + a 3-hour practical session per week for one semester
NQF Credits	16
Course Assessment:	Continuous assessment (at least 2 tests and 1 assignments) 50%; 1 x 3 hours Examination 50%
Prerequisite	CMP2411 Introduction to Computer Systems

Course Description: This course introduces students to the basics of computer networks. Its content is equivalent to that of CCNA1 and CCNA2, and covers the following topics: Introduction to Networking, Network Structure, Cabling LANs and WANs, Ethernet Fundamentals and Technologies, TCP/IP Protocol Suite, IP Addressing, Basics of Subnetting, Routing and Routing Protocols, Routers configurations, Basic Router Troubleshooting, Access Control Lists (ACLs).

CMP2511 FUNDAMENTALS OF DATABASE SYSTEMS

Course Title:	**FUNDAMENTALS OF DATABASE SYSTEMS**
Course Code	CMP2511
NQF Level	5
Contact Hours	4 lectures + a 3-hour practical session per week for one semester
NQF Credits	16
Course Assessment:	Continuous assessment (at least 2 tests and 1 assignments) 50%; 1 x 3 hours Examination 50%
Prerequisite	CMP2411 Introduction to Computer Systems

Course Description: This course introduces the fundamentals of databases management sytems and covers the following topics: Basic concepts of databases; types of databases; Evolution of Database technologies; Database Design; Conceptual Data Modeling; Types of entities; ER diagrams; Writing SQL statements; Using PL/SQL; Managing Databases; Administering a Database.

CMP2531 FUNDAMENTALS OF SYSTEMS ADMINISTRATION

Course Title:	**FUNDAMENTALS OF SYSTEMS ADMINISTRATION**
Course Code	CMP2531
NQF Level	5
Contact Hours	4 lectures + a 3-hour practical session per week for one semester
NQF Credits	16

Course Assessment:	Continuous assessment (at least 2 tests and 1 assignments) 50%; 1 x 3 hours Examination 50%
Prerequisite	CMP2411 Introduction to Computer Systems

Course Description: This course introduces the fundamentals of Systems Administration and covers the following topics: Introduction to Systems administration; Basic issues in systems administration; Essential Administrative Tools; Creating and managing User Accounts; Overview of the UNIX / Linux system: directory structure, Simple shell scripting, Structure of a file system, Administering secondary storage management, TCP / IP Network Management, Data Management, standards and best practices in systems administration.

CMP2571 PROGRAMMING I

Course Title:	PROGRAMMING I
Course Code	CMP2571
NQF Level	5
Contact Hours	4 Lectures per Week + 3 hour practical per week for one semester
NQF Credits	16
Course Assessment:	Continuous assessment (at least 2 tests and 1 assignments) 50%; 1 x 3 hours Examination 50%
Corequisite	CMP2412 Programming Principles

Course Description: This course builds on Programming principles and will cover the following topics: -PROBLEM SOLVING STRATEGIES: The role of algorithms in the problem solving process, Implementation strategies for algorithms, Debugging strategies, The concept and properties of algorithms. PROGRAM DEVELOPMENT STEPS: Planning Phase, Analysis, Design, Implementation, Testing, Maintenance. PROGRAMMING CONSTRUCTS: Primitive data types, Variables, Expressions & assignment, Strings and string processing, Arrays, Records, Files, Scope and lifetime of variables, Strategies for choosing the right data structures. CONDITIONAL AND ITERATION CONSTRUCTS: The Selection structure, Comparison operators, Logical operators, Nested selection structures, The Case selection structure, The Repetition structure, The For…Next Statement, The Do…Loop Statement. EVENT-DRIVEN PROGRAMMING CONSTRUCTS: Event-handling methods, Event propagation, Exception handling, Functions and Parameter passing, Structured Decomposition.

CMP2512 DATABASE MANAGEMENT

Course Title:	DATABASE MANAGEMENT
Course Code:	CMP2512
NQF Level	5
Contact Hours	4 lectures + a 3-hour practical session per week for one semester
NQF Credits	16
Course Assessment:	Continuous assessment (at least 2 tests and 1 assignments) 50%; 1 x 3 hours Examination 50%
Co-requisite	CMP2511 Fundamentals of Database Systems
Prerequisite	CMP2411 Introduction to Computer Systems

Course Description: This course uses the Oracle Database Management System. It covers the following topics: Oracle Database Architecture, Understanding Instances, Managing Tablespaces and Datafiles, Managing Tables and Indexes, Managing Data, Managing Users and Security, Networking, Backup and Recovery, loading and moving data, Globalization Support.

CMP2532 SYSTEM ADMINISTRATION

Course Title:	**SYSTEM ADMINISTRATION**
Course Code	CMP2532
NQF Level	5
Contact Hours	4 lectures + a 3-hour practical session per week for one semester
NQF Credits	16
Course Assessment:	Continuous assessment (at least 2 tests and 1 assignments) 50%; 1 x 3 hours Examination 50%
Co-requisite	CMP2531 Introduction to System Administration
Prerequisite	CMP2411 Introduction to Computer Systems

Course Description: This course follows on Introduction to Systems administration and covers the following topics: Essential Administrative Tools. Managing User Accounts; Installing, administering and configuring a multi-user and multi-tasking operating system like Linux. Network configuration: Basic networking services such as DNS, DHCP and LDAP, Web gateway; Email Gateway.

CMP2552 NETWORK ADMINISTRATION

Course Title:	**NETWORK ADMINISTRATION**
Course Code	CMP2552
NQF Level	5
Contact Hours	4 lectures + a 3-hour practical session per week for one semester
NQF Credits	16
Course Assessment:	Continuous assessment (at least 2 tests and 1 assignments) 50%; 1 x 3 hours Examination 50%
Corequisite	CMP2551 Fundamentals of Computer Networks
Prerequisite	CMP2411 Introduction to Computer Systems

Course Aims: This courses aims to consolidate the concepts introduced in Introduction to Computer Networks. Its content is equivalent to that of CCNA3 and CCNA4, enabling the students that complete the course to go for CCNA certification. Particular emphasis is given to students being able to demonstrate the ability to apply what they learned in Introduction to Computer Networks and to be able to explain how and why a particular network strategy can be employed.

CMP2572 PRORAMMING II

Course Title:	**PROGRAMMING II**
Course Code	CMP2572
NQF Level	5

Contact Hours	4 Lectures per Week + 3 hour practical per week for one semester
NQF Credits	16
Course Assessment:	Continuous assessment (at least 2 tests and 1 assignments) 50%; 1 x 3 hours Examination 50%
Corequisite	CMP2571 Programming I
Prerequisite	CMP2412 Programming Principles

Course Description: Introduction to OOP applications: Design and Implementation of the .NET Framework, The Common Language Runtime, The .NET Framework Class Library, Creating a .NET Application. Designing windows based applications using the Visual Studio.NET IDE: Organizing a Windows based application, Using controls (e.g. Scroll Bar, groupbox, etc), Introduction to event handlers, Dynamic event handling. Creating programs using component based programming: Introduction to Component Based Programming, Controlling Visibility with Access Modifiers, Introduction to Classes, Object Oriented Programing concepts; Inheritance; polymorphism, abstraction, Exception Handling.

F.3. DEGREE PROGRAMMES

F.2.1. REGULATION PERTAINING TO THE DEGREE PROGRAMMES

F.3.1.1. ADMISSION REQUIREMENTS

To register for an undergraduate degree programme in the School of Science, a candidate must hold a valid Namibian Senior Secondary Certificate (NSSC) (ordinary or higher) or a recognised equivalent qualification.

English is a compulsory subject and should normally have been obtained as a Second Language at NSSC (O level) with a minimum C symbol or English as a First Language at NSSC (O level) with a minimum D symbol. In addition to the above, admission to the Bachelor of Science in Computer Science Honours, Bachelor of Science in Information Systems Honours and the Bachelor of Science in Information Technology Honours programme requires at least a symbol C on NSSC or equivalent qualification in Mathematics.
A candidate should obtain a minimum of 25 points on the UNAM Evaluation Point Scale in his/her five (5) best subjects (of which Mathematics and English must be included) to be admitted to this degree programme (Refer to the General Admission Criteria for Undergraduate Programmes in the General Information and Regulations Yearbook). Obtaining the minimum number of points, however, does not necessarily ensure admission as it is based on places available in the programme and is awarded on the basis of merit. Nevertheless, exemption rules for students who have completed a Diploma in Computer Science should apply.

Admission can also be considered for persons who qualify through the Mature Age Entry Scheme upon successful completion of the relevant examinations as set out in the General Information and Regulations Prospectus. Such candidates may also be required to pass a Departmental entry test before admission is granted.

In addition to the School of Science entry requirements, students wishing to register for the degree programmes offered by the Department of Computing, Mathematical & Statistical Sciences will be expected to pass a Department Entry Selection test. This test is an aptitude test and will in no way affect students that are coming from backgrounds without Computer Studies as a subject. The test is normally given before registration, to enable students who do not qualify to select other programmes.
Please read this section in conjunction with the academic conditions stipulated in the General Information and Regulations Prospectus.

F.3.1.2. DURATION OF STUDY

The Bachelor of Science in Computer Science Honours, Bachelor of Science in Information Systems Honours and the Bachelor of Science in Information Technology Honours degree programme cannot be completed in less than four (4) years. However, it must be completed within a period of six (6) years of full-time study, unless special permission is granted for this period to be exceeded.

F.3.1.3. MODE OF DELIVERY

The Bachelor of Science in Information Technology Honours, Bachelor of Science in Information Systems Honours and the Bachelor of Science in Information Technology Honours programme is offered on a full-time mode. The mode of delivery consists of a combination of lectures, tutorials, lab practicals, research projects and industrial attachments. In order to be admitted to examinations, students are required to attend at least 80% of the lectures and to complete the required elements that make up the continuous assessment marks. Attendance of practical and tutorial classes is compulsory for all courses that have these components.

F.3.1.4. ASSESSMENT CRITERIA

Unless otherwise indicated, the relationship between the CA mark and the Examination mark is 50:50.All taught modules will be assessed using a combination of continuous assessment (50%) and an examination (50%) mark. Continuous assessment will consist of a subset of the following, depending on the module: class tests, assignments, presentations, practical/laboratory demonstrations and reports. All examinable modules will have an examination administered at the end of each semester. Only candidates who obtained the required minimum continuous assessment mark of 40% will be eligible to write the examinations.

F.3.1.5. MINIMUM REQUIREMENTS FOR RE-ADMISSION

To be re-admitted to the Bachelor of Science in Computer Science / Information Systems / Information Technology Honours degree programme for a particular year of registration, a student must have passed the minimum number of courses as indicated below:

- 4 courses (equivalent to 64 credits) by the end of the first year; 2 of these courses (equivalent to 32 credits) must be non-core,
- 8 courses (equivalent to 144 credits) by the end of the second year,
- 15 courses (equivalent to 240 credits by the end of the third year, and
- 23 courses (equivalent to 368 credits) by the end of the fourth year

F.3.1.6. ADVANCEMENT AND PROGRESSION RULES

A student advances to the following academic level of study when at least 2/3 of the courses of the curriculum for a specific year have been passed. If a student passed only 1/3 of the full curriculum of a specific year, he/she may not register for any courses of the following year. In all cases, prerequisites for courses have to be passed before a student can proceed to register for courses that require prerequisites.

- From year 1 to 2: At least 7 modules (equivalent to 112 credits) prescribed for year 1.
- From year 2 to 3: All first-year modules plus at least 5 modules (equivalent to 80 credits) prescribed for year 2.
- From year 3 to 4: All second-year modules plus at least 5 modules (equivalent to 80 credits) prescribed for year 3.

F.3.1.7. MAXIMUM NUMBER OF COURSES PER YEAR

Full-time students can register for all first year courses and thereafter, no more than 12 courses in any academic year.

F.3.1.8. ARTICULATION ROUTE

The Bachelor of Science in Computer Science Honours, Bachelor of Science in Information Systems Honours and the Bachelor of Science in Information Technology Honours qualifications serve as an entry point to the Master of Science in Information Technology, provided that a student graduates with a minimum of a lower second class (60-69% average).

F.4. BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY Honours, CURRICULUM AND PRE-REQUISITES

QUALIFICATION: Bachelor of Science in Information Technology Honours (22BSIT)

Students opting for a Bachelor of Science in Information Technology must take all of the following courses:

YEAR 1

CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 1 Semester 1					
LCE3419	English Communication & Study Skills	4	16		None
MAT3511	Basic Mathematics	5	16		None
CLC3509	Computer Literacy	5	8		None
CMP3511	Programming Fundamentals I	5	16		None
CIT3511	Introductions to Digital Electronics	5	16		None
CIT3521	Fundamentals of Information Technology I	5	8		None
Year 1 Semester 1					
LEA3519	English for Academic Purposes	5	16	LCE3419	None
CSI3580	Contemporary Social Issues	5	8		None
CMP3512	Programming Fundamentals II	5	16		CMP3511
MAT3512	Pre-calculus	5	16		None
STS3522	Introduction to Statistics	5	8		None
CIT3512	Fundamentals of Information Technology II	5	16		CIT3521
Total Credits			160		

YEAR 2

CODE	COURSE NAME	NQF Level	CREDITS	PREREQUISITES	COREQUISITES
Year 2 Semester 1					
CMP3611	Introduction to Database Systems	6	16	CMP3512	
COS3611	Object Oriented Programming I	6	16	CMP3512	
CIT3631	Discreet Mathematics Concepts	6	16	MAT3512 & MAT3511	
CIT3611	Computer Networks I	6	16	CIT3511	
Year 2 Semester 2					
COS3632	Advanced Databases	6	16	CMP3511	CMP3611
COS3612	Object Oriented programming II	6	16	CMP3511& CMP3512	COS3611
CIT3632	Telecommunications	6	16	CIT 3521and CIT3511	CIT3631
CIT3612	Computer Networks II	6	16	CIT 3511	CIT3611
Total Credits			128		

YEAR 3

CODE	COURSE NAME	NQF Level	CREDITS	PREREQUISITES	COREQUISITES
Year 3 Semester 1					
CIT3711	Advanced Computer Networks		16	CIT3612 and CIT3632	
CMP3731	Software Engineering		16	CMP3512 COS3612	
CIT3731	Information Security		16	CIT3612 & CIT3611	
CIT3771	Systems Administration and Maintenance		16	CIT3512 and CIT3612	
Year 3 Semester 1					

CMP3712	Internet Technologies and Applications		16	CIT3632 and CIT3612	
COS3712	Human Computer Interaction		16	COS3612	CMP3731
CMP3752	Research Methodology		16	STS 3522 & COS3612	
CIT3732	Platform Technologies		16	CIT3632 &CIT3612	CIT3711
Total Credits			128		

YEAR 4

CODE	COURSE NAME	NQF Level	CREDITS	PREREQUISITES	COREQUISITES
CIT3810	Research Project	8	32	Pass all Third Year Courses	None
CMP3821	Network System Security	8	8	CIT3612& COS3731 OR CIT3711	None
CMP3841	Wireless and Mobile Computing	8	8	CIT3612& COS3731 OR CIT3711	None
CIT3811	IT Project Management	8	16	CMP3712& CMP3731	None
	Choose any ONE of the following TWO courses:				
CMP3851	Distributed Systems	8	16	CIT3612	None
COS3871	Artificial Intelligence	8	16	CMP3512, COS3612& CIT3631 OR CMP3711	None
CMP3832	Entrepreneurship and Management of IT Systems	8	16	COS3712	None
	Choose any TWO of the following courses:				
CMP3852	Expert Systems	8	16	CIT3631 & COS3712	COS3871
CMP3812	Real Time Multimedia	8	16	CMP3731,CIT3612	None
CIT3812	Cloud Computing	8	16	COS3632 & CIT3711	None
Total Credits			128		

F.4.1. BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY Honours COURSE DESCRIPTIONS

FIRST YEAR COURSES

CIT3511 INTRODUCTION TO DIGITAL ELECTRONICS

Course title: **Introduction to Digital Electronics**
Code: CMP3511
NQF level: 5
Contact hours: 4 lecture periods / week for one semester; 3 hour practical session/ week, for one semester
Credits: 16
Course Assessment: Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisites: None

Course Description: This course introduces the student to the basic theory of semi-conductor electronics. The topics covered in the course are: THE ATOMIC STRUCTURE: - The molecule; atomic and molecular bonds; ionic binding; metallic bonds; insulators and semiconductors. Band model; intrinsic semiconductors; conduction by electrons and holes; carrier concentration;Photo-conduction and voltaic effects:- The P-N junction; V-I characteristics; diode resistance; Zener, tunnel, photo and light emitting diodes; Diode circuits; The bipolar junction transistor; common base, common emitter, common collector configurations and their characteristics; Transistor circuits; The transistor as a switch; Field effect transistors.

CIT3521 FUNDAMENTALS OF INFORMATION TECHNOLOGY I

Course Title: **Fundamentals of Information Technology I**
Course Code CIT3521
NQF Level 5
Notional Hours 80
NQF Credits 8
Course Assessment Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Contact Hours 2 lecture periods per week and half a practical session per week for one semester
Prerequisite None

Course Descriptions: This course introduces pervasive Themes in Information Technology and covers the following topics: IT and Its Related Disciplines, Application Domains, History of the Internet; Communications media; Data transmission; Information technology security; Operating systems; Introduction to Web design and Web applications, Web technologies.

CIT3512 FUNDAMENTALS OF INFORMATION TECHNOLOGY II

Course Title:	**Fundamentals of Information Technology II**
Course Code	CIT3512
NQF Level	5
NQF Credits	16
Contact Hours	4 lecture periods per week and onepractical session per week for one semester
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Co-Requisites:	CIT3521Fundamentals of Information Technology I

Course Descriptions: This course is a follow up on Fundamentals of Information Technology I, and covers the following topics: Introduction to Data Communications; Introduction to Wired and wireless LAN technologies; Introduction to Telecommunications Systems; telecommunications standards and protocols; principles behind telecommunications; Networking fundamentals; Telecommunication Fundamentals; Industry standards, topologies and protocols;

SECOND YEAR COURSES

CIT3631 DISCRETE MATHEMATICS CONCEPTS

Course Title:	**Discrete Mathematics Concepts**
Course Code	CIT3631
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Assessment	Continuous Assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisite	MAT3512 Precalculus& MAT 3511 Basic mathematics

Course Content: This course introduces Discrete Mathematics concepts. It covers the following topics: METHODS OF PROOF AND MATHEMATICAL INDUCTION; COUNTING: permutations, combinations, the pigeon-hole principle, elements of probability, and recurrence relations. RELATION: types and properties of relations, along with their representation as directed graph. FUNCTIONS: This part deals with the notion of a function and gives important examples of functions, including functions of special interest in computer science Simple linear Function and Equation. TREES: directed and undirected trees along with applications of these ideas. GRAPHS AND FINITE-STATE MACHINES: elementary graph theory, finite-state machines. SETS AND RANDOM EXPERIMENTS: Union, intersection, Venn diagrams.

CIT3611 COMPUTER NETWORKS I

Course Title:	**Computer Networks I**
Course Code	CIT3611
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Assessment	Continuous Assessment 50%, Examination 50% (1 x 3 hour paper)
Prerequisite	CIT3511 Introduction to Digital Electronics

Course Content: This course explains the principles of Computer Network and covers the following topics: ISO reference models; TCP/IP; modulation techniques; networking devices; network topologies; Ethernet; network architecture; protocols; client server and peer to peer paradigms; network standards; physical and data link layer (error control, framing, flow control); internetworking and routing; services of the network layers; introduction to network security.

CIT3632 TELECOMMUNICATIONS

CourseTitle	**Telecommunications**
Course Code	CIT3632
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Assessment	Continuous Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3521 Fundamentals of Information Technology I & CIT3511 Introduction to Digital Electronics

Course Content: This course presents the principles and practice of wireless communications. It covers the following topics: frequency reuse and cellular structure: propagation effects, multipath fading, digital and analog modulation, diversity and equalization, multiple access and wireless networks. Modern wireless systems and standards.

CIT3612 COMPUTER NETWORKS II

Course Title	**Computer Networks II**
Course Code	CIT3612
NQF Level	6

Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite	CIT3511 Introduction to Digital Electronics
Co-requisite	CIT3611 Computer Networks I

Course Aims: This course covers the skills of operating the networking devices, and covers the following topics: configuring and managing networking devices; creating VLAN's and VPN's; restricting access using access control lists(ACL's) and standard access lists; troubleshooting the network; addressing technologies.

CIT3652 COMPUTER ORGANISATION AND ARCHITECTURE

Course Title:	**Computer Organization and Architecture**
Course Code	CIT3652
NQF Level	6
Contact Hours	4 lecture periods per week and one practical session every week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CIT3511Introduction to Digital Electronics and CIT3512Fundamentals of Information Technology II

Course Content: This course covers the following topics: Advance Digital Design : Combinational and Sequential Circuit Design; Control unit, Stored program, addressing schemes; Memory organization; Input-Output Organization; principles of serial and parallel, synchronous and asynchronous communications; Interrupt handling, Input and output Channels, DMA and IOP, Standard I/O Interfaces; Machine language addressing methods and Instructions, Program Sequencing with respect to Microprocessors or Microcontrollers; discuss different computer architectures; Design and modeling of disks and redundant Arrays; interrupts and DMA; illustrates Peripheral interfaces;

THIRD YEAR COURSES

CIT3711 ADVANCED COMPUTER NETWORKS

Course Title	**Advanced Computer Networks**
Course Code	CIT3711
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Assessment	Continuous Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3611 Computers Networks I, CIT 3612 Computers Networks II and CIT3632 Telecommunications

Course Contents: This course covers the following topics: Routing and Packet Forwarding: static and dynamic routing configuration. Verifying network operations. Routing protocols: distance vector and link-state; VLSM (Variable Length Subnet Mask) and CIDR (Classless Inter-Domain Routing); classless routing protocols; classful routing protocol; structure of the routing table. Forwarding architecture, traffic engineering.

CIT3731 INFORMATION SECURITY

Course Title	**Information Security**
Course Code	CIT3731
NQF Level	7
NQF Credits	16
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
Assessment	Continuous Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3611 Computer Networks I and CIT3612 Computer Networks II

Course Description: This course looks at the attacks that are launhced against computer systems and networks. It covers the following topics: Malware and social engineering attacks: viruses, trojans, worms, denial of service attacks, phishing, and even Wiki leaks. Confidentiality, integrity, and availability. Information Classification; Policy Development; Secure Systems Architecture, Systems Integrity Engineering. Ethics, legal and Regulatory Issues, Computer Abuse Methods and Detection. Computer Crime Investigation and Computer Forensics.

CIT3771 SYSTEM ADMINISTRATION AND MAINTENANCE

Course Title	**System Administration and Maintenance**
Course Code	CIT3771
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Assessment	Continuous Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3632 Fundamentals of Information Technology II and CIT3612 Computer Networks II

Course Content: This course examines the principles of System Administration and Maintenance. It covers the following topics: Windows Client Installation, Configuration and Administration; Windows Server Management and Maintenance; UNIX Use, Configuration and Administration; Computer Upgrade and Maintenance. Processes and scheduling, Peripheral Management, Disk Management.System Maintenance .System Management Interface Tool - SMIT • AIX Review .User & Group Management .System Startup& Shutdown .Backups and security.

CIT3732 PLATFORM TECHNOLOGIES

Course Title	**Platform Technologies**
Course Code	CIT3732
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite	CIT3632 Telecommunications & CIT3612 Computer Networks II
Co-requisites	CMP3712 Internet Technologies and Applications and CIT3711Advanced Computer Networks

Course Description: Advanced Computer Architecture: computer memory hierarchy and its implementation, input/output operations, use of assembly language programming, instruction sets, arithmetic and logical operations, addressing modes and macro definition. A fundamental theory and design methods for digital systems.Architecture-machine performance relationships, computer classifications, and computer description languages. Parallel Architecture: development of broad working knowledge of probability, petri net, asynchronization parallelism: MIMD System, synchronous parallelism: SIMD System, computer systems simulation, and empirical analysis techniques as applied to computer systems modeling.

FOURTH YEAR COURSES

CIT3811 IT PROJECT MANAGEMENT

Course Title	**IT Project Management**
Course Code	CIT3811
NQF Level	8
NQF Credits	16
Assessment	Continuous Assessment 50%, Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3712 Internet Technolgies and Applications& CMP3731 Software Engineering

Course Description: This course is designed to teach students the basic principles of project management. Topics will include project management function; project management process; project integration; scope and time frames; quality; human resources; communication; procurement; network scheduling; cost and risk management. Students will learn how to identify and schedule project resources, carry out resource allocation, create project flow charts, produce critical path planning and evaluate reports. Emphasis will also be on tools such as Programme Evaluation and Review Technique (PERT) charts and Critical Path Method (CPM) charts. Important issues of staff selection and team management will also be covered. These learning objectives will be reinforced by a team project that allows students to apply the principles and use the tools they learned.

CIT3810 RESEARCH PROJECT

Course Title	**Research Project**
Course Code	CIT3810
NQF Level	8
NQF Credits	32
Pre-requisite	Pass All Third Year Courses

Course Description: Identification of research topic; literature review; requirement elicitation and specification; requirement analysis; proposal development and presentation; software design and implementation; testing; deployment and evaluation; report writing; field attachment.

CIT3812 EXPERT SYSTEMS

Course Title	**Expert Systems**
Course Code	CMP 3852
NQF Level	8
NQF Credits	16
Assessment	Continuous Assessment 50%, Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3631 Discreet Mathematics Concepts & COS3712 Human Computer Interaction
Core-requisite	COS3871 Artificial Intelligence

Course Content: The module will cover the following topics: - Characteristics of Expert Systems, The Development of Expert Systems Technology, Expert Systems Application and Domains, Elements of an Expert System, Programming Paradigms, Representation of Knowledge, Semantic Nets, Schemata, Frames, Methods of Inference, Reasoning under Uncertainty. Introduction to CLIPS, The CLIPS Tool, CLIPS in Expert Systems, Expert Systems Design Examples. The Design of Expert Systems, Pattern Matching, Modular Design and Execution Control. Efficiency in Rule-Based Languages, A Pattern Matching Algorithm, The Pattern Network, Built-in Pattern Matching Constraints, General Rules v/s Specific Rules, Simple Rules v/s Complex Rules, Loading and Saving Facts.

CIT3812 CLOUD COMPUTING

Course Title:	**Cloud Computing**
Course Code	CIT3812
NQF Level	8
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Assessment	Continuous Assessment 50%, Examination 50% (1 x 3 hour paper)
Pre-requisite	COS3632 Advanced Databases & CIT3711Advanced Computer Networks

Course Description: Cloud technologies: software as a service, platform as a service, infrastructure as a service, virtualization, computing layers and operating system. Cloud security: threats and potential vulnerabilities. Intelligent web applications: advanced information retrieval, analysis and visualisation and handling data in the cloud, client-server architectures and high-bandwidth, cloud taxonomy, cloud storage, vendors, challenges, ownership, data centres, databases, models.

F.5. BACHELOR OF SCIENCE IN COMPUTER SCIENCE Honours, CURRICULUM AND PREREQUISITES

QUALIFICATION: Bachelor of Science in Computer Science Honours (22BSCO)

Students opting for a Bachelor of Science in Computer Science Honours must take all of the following courses:

YEAR 1

CODE	COURSE NAME	NQF Level	CREDITS	PREREQUISITES	COREQUISITES
Year 1 Semester 1					
LCE3419	English Communication & Study Skills	4	16		None
CLC3509	Computer Literacy	5	8		None
MAT3511	Basic Mathematics	5	16		None
CMP3511	Programming Fundamentals I	5	16		None
CIT3511	Introductions to Digital Electronics	5	16		None
CIT3521	Fundamentals of Information Technology I	5	8		None
Year 1 Semester 2					
LEA3519	English for Academic Purposes	5	16		None
CSI3580	Contemporary Social Issues	5	8		None
MAT3512	Precalculus	5	16		None
CMP3512	Programming Fundamentals II	5	16		CMP3511
CIT3512	Fundamentals of Information Technology II	5	16		CIT3521
STS3522	Introduction to Statistics	5	8		None
Total credits			160		

YEAR 2

CODE	COURSE NAME	NQF Level	CREDITS	PREREQUISITES	COREQUISITES
Year 2 Semester 1					
CMP3611	Introduction to Database Systems	6	16	CMP3512	None
COS3611	Object Oriented Programming I	6	16	CMP3512	None
CMP3651	Mathematics for Computer Science	6	16	MAT3511 & MAT3512	None
CIT3611	Computer Networks I	6	16	CIT3511	None
Year 2 Semester 2					
COS3632	Advanced Databases	6	16	CMP3511	CMP3611
COS3612	Object Oriented programming II	6	16	CMP3511 & CMP3512	COS3611
CIT 3612	Computer Networks II	6	16	CIT3511	CIT3611
CIT3652	Computer Organization & Architecture	6	16	CIT3511 & CIT3512	None
Total credits			128		

YEAR 3

CODE	COURSE NAME	NQF Level	CREDITS	PREREQUISITES	COREQUISITES
Year 3 Semester 1					
CMP3711	Computer Theory	7	16	CMP3651& COS3612	None
CMP3731	Software Engineering	7	16	COS3612	None
COS3731	Emerging Technologies	7	16	CIT3611 & CIT3612	None
COS3711	Data Structures and Algorithms	7	16	COS3612	None
Year 3 Semester 2					
COS3732	Operating Systems	7	16	COS3612 &CIT3652	COS3711
COS3712	Human Computer Interaction	7	16	COS3612	CMP3731
CMP3752	Research Methodology	7	16	COS3612 & STS3522	None
CMP3772	Web Design & Programming	7	16	COS3612 & COS 3632	None
Total Credits			128		

YEAR 4

CODE	COURSE NAME	NQF Level	CREDITS	PREREQUISITES	COREQUISITES
Year 4 Semester 1					
CMP3810	Research Project	8	32	Pass all third year	None
CMP3821	Network System Security	8	8	CIT3612& COS3731 OR CIT3711	Network System Security
CMP3841	Wireless and Mobile Computing	8	8	CIT3612& COS3731 OR CIT3711	Wireless and Mobile Computing
	Choose any TWO of the following courses:				
CMP3811	Numerical Methods and Operations Research	8	16	CMP3651	None
CMP3851	Distributed Systems	8	16	CIT3612 & COS3711	None
COS3871	Artificial Intelligence	8	16	CMP3512, COS3612& CIT3631 OR CMP3711	None
Year 4 Semester 2					
COS3812	Data warehousing & Data Mining	8	16	COS3632 & COS3711	None
	Choose any TWO of the following courses:				
CMP3832	Entrepreneurship and Management of IT Systems	8	16	COS3712	None
CMP3812	Real Time Multimedia	8	16	CIT3611, CIT3612 & COS3731/CMP3712	None
CMP3872	Database Programming	8	16	CMP3772, COS3632 & COS3612	None
Total Credits			128		

F.5.1. BACHELOR OF SCIENCE IN COMPUTER SCIENCE HONOURS COURSE DESCRIPTIONS

FIRST YEAR COURSES

CMP3511 PROGRAMMING FUNDAMENTALS I

Course title:	**Programming Fundamentals I**
Code	CMP3511
NQF level:	5
Contact hours:	4 lecture periods / week for one semester; 3 hour practical session per week, for one semester
Credits:	16
Course Assessment:	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Final Examinations 50%
Prerequisites:	None

Course description: This course introduces the students to the foundational skills for all computing disciplines. It develops the student's skills and concepts that are essential to good programming practice and problem solving. The course will cover the following topics: -PROBLEM SOLVING STRATEGIES: The role of algorithms in the problem solving process, Implementation strategies for algorithms, Debugging strategies, The concept and properties of algorithms. PROGRAM DEVELOPMENT STEPS: Planning Phase, Analysis, Design, Implementation, Testing, Maintenance. PROGRAMMING CONSTRUCTS: Primitive data types, Variables, Expressions & assignment, Strings and string processing, Arrays, Records, Files, Scope and lifetime of variables, Strategies for choosing the right data structures. CONDITIONAL AND ITERATION CONSTRUCTS: The Selection structure, Comparison operators, Logical operators, Nested selection structures, The Case selection structure, The Repetition structure, The For…Next Statement, The Do…Loop Statement. EVENT-DRIVEN PROGRAMMING CONSTRUCTS: Event-handling methods, Event propagation, Exception handling, Functions and Parameter passing, Structured Decomposition.

CMP3512 PROGRAMMING FUNDAMENTALS II

Course title:	**Programming Fundamentals II**
Code	CMP3512
NQF level:	5
Contact hours:	4 lecture periods / week for one semester; 3 hour practical session per week, for one semester
Credits:	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Co-Requisites:	CMP3511 Programming Fundamentals I

Course description: This course is a follow up on Programming Fundamentals 1 and provides the student with a rich set of tools to create advanced programs as required in today's business environment. The course will cover the following topics: Introduction to vb.net applications: Design and Implementation of the .NET Framework, The Common Language Runtime, The .NET Framework Class Library, Creating a .NET Application. Designing windows based applications using the Visual Studio.NET IDE: Organizing a Windows based application, Using controls (e.g. Scroll Bar, groupbox, etc), Introduction to event handlers, Dynamic event handling. Creating programs using component based programming: Introduction to Component Based Programming, Controlling Visibility with Access Modifiers, Introduction to Classes, Introduction to the Object-Oriented Paradigm, Exception handling.

SECOND YEAR COURSES

CMP3611 INTRODUCTION TO DATABASE SYSTEMS

Course Title:	**Introduction to Database Systems**
Course Code	CMP3611
NQF Level	Contact Hours 4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CMP3512 Programming Fundamentals II

Course Content: This course introduces students to databases, and covers the following topics: Types of databases; Evolution of Database technologies; Database technology versus conventional file-processing systems; The enterprise data model; Conceptual Data Modeling; Types of entities; ER diagrams to relation transformation; Business rules; Integrity Control Statements; Writing SQL statements; Functional Dependencies; Normalization and Denormalization.

COS3611 OBJECT ORIENTED PROGRAMMING I

Course Title	**Object Oriented Programming I**
Course Code	COS3611
NQF Level	6
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisites	CMP3512 Programming Fundamentals II

Course Aims This course aims to advance the understanding of object-oriented programming and to develop knowledge and skills in OOP design and program development. The course will cover the following topics: OOP Design, Classes, Objects and Methods, Interfaces and Abstract classes; Exceptions and I/O Streams ; Vectors and Iterators; Introducing Abstract Data (ADT).

COS3632 ADVANCED DATABASES

Course Title: **Advanced Databases**
Course Code COS3632
NQF Level 6
Contact Hours 4 lecture periods per week and 1x3-hour practical session per week for one semester
NQF Credits 16
Course Assessment Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite CMP3512 Programming Fundamentals II
Co-Requisites CMP3611 Introduction to Database Systems
Course Aims This course aims to strengthen database principles covered in Introduction to Databases. It focuses on the following topics: Overview of storage and indexing; Cost Models Storing Data; Overview of Transaction Management; Concurrency control; Security and Authorization; encryption

CMP3651 MATHEMATICS FOR COMPUTER SCIENCE

Course Title **Mathematics for Computer Science**
Course Code CMP3651
NQF Level 6
Contact Hours 4 lecture periods per week and one practical session every week for one semester
NQF Credits 16
Course Assessment Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite MAT3511 Basic Mathematics & MAT 3512 Precalculus
Course Content: This course emphasizes the mathematical foundations required for Computer Science. It covers the following topics: Representation of Numbers in the Computer; Logical Statements and Truth Tables; Predicate Logic; Relations; Functions or Mapping; domain; Sequences; Graphs; Computational Geometry; Number Theory and Methods of Proof; coordinate Geometry; Numerical and Algebraic Expressions; Monomials and Polynomials; Partial fractions; Equations; Inequalities; Vectors; Matrices and Determinants; Fundamental Principles of Counting; Permutations and Combinations; Binomial Theorem; Multinomial Theorem; Variables and Functions; Review of Basic Elementary Functions and Derivative; Complex Numbers; Differential Equations; Integrals.

COS3612 OBJECT ORIENTED PROGRAMMING II

Course Title **Object Oriented Programming II**
Course Code COS3612
NQF Level 6
Contact Hours 4 lecture periods per week and 1 practical session per week for one semester
NQF Credits 16
Course Assessment Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite CMP3512 Programming Fundamentals II
Co-requisite COS3611 Object Oriented Programming I
Course Content: This course builds on Object Oriented programming I, and covers the following topics: Abstract Classes; Interfaces, Threads; Generic methods and collections; GUI: collections, I/O, layouts; design patterns; testing; Exception handling; Inheritance and Polymorphism; Applets; Streams and File Manipulation; Basic data structures: Lists, Stacks, queues Trees; Heaps; Hash tables; Graphs.

THIRD YEAR COURSES

CMP3711 COMPUTER THEORY

Course Title: **Computer Theory**
Course Code CMP3711
NQF Level 7
Contact Hours 4 lecture periods per week and one practical session every week for one semester
NQF Credits 16
Course Assessment Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite CMP3651 Mathematics for Computer Science and COS3612 Object Oriented Programming II
Course Content: This course covers the following topics: Functions, Relation, Sets, Propositional and Predicate logic; quantifiers; graphs and trees; algebraic structures; Tautologies, contradictions and contingencies; Proofs; Recursive definitions and recurrence relations; Program correctness; Huffman codes; Algebraic structures; Error-detecting/correcting capabilities of codes; Syndromes; Languages; Regular expressions; Automata theory; Push-down Automata (PDAs) theory; context-free grammars; Pumping lemma theory; Universal Turning theory; computability, decidability and tractability.

COS3731 EMERGING TECHNOLOGIES

Course Title: **Emerging Technologies**
Course Code COS3731
NQF Level 7
Contact Hours 4 lecture periods per week and one practical session every week for one semester
NQF Credits 16
Course Assessment Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite CIT3611Computer Networks I and CIT3612 Computer Networks I I
Course Content: This course discusses new and trendy developments in technology related to the following topics: Emerging Technology, Telecommunication Convergence, Convergence in Evolutionary Computing, Leading Technologies, Emerging mobile

and web technologies; Networking solutions and status; Cloud computing; Network evolution to support new services; Current Applications and Markets.

COS3711 DATA STRUCTURES AND ALGORITHMS

Course Title	**Data Structures and Algorithms**
Course Code	COS3711
NQF Level	7
Contact Hours	4 lecture periods per week and one practical session every week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre -Requisite	COS3612 Object Oriented Programming II

Course Content: This course looks at the process of analysing of algorithms used to perform common functions in computer science. It will cover the following topics: Review of object-oriented framework; Common data Structures and Complex Data Structures; List; Algorithm Analysis; Sorting; Searching; Advanced Tree Structures; Hash tables; Hash function; Re-hashing; Priority Queues (Heaps); File compression; Huffman coding; Graphs; Adjacency Matrix and List; Connectivity; Topological sort; Shortest path algorithms; minimum Spanning Tree; hard or Intractable problems; dynamic Algorithms; dictionaries; traveling Salesman's Problem.

CMP3731 SOFTWARE ENGINEERING

Course Title	**Software Engineering**
Course Code	CMP3731
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Assessment	Continuous Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CMP3512 programming Fundamentals II and COS3612 Object Oriented Programming II

Course Description: This course looks at the nature of software engineering and covers the following topics: software process models; agile software development; requirements engineering; analysis and system modeling; architectural design; component level design; object oriented design; user interface design; software testing strategies and principles of quality management; review techniques; software metrics; formal methods; software maintenance; re-engineering and reuse; capability Maturity Model; future trends in software engineering.

CMP3712 INTERNET TECHNOLOGIES AND APPLICATIONS

Course Title	**Internet Technologies and Applications**
Course Code	CMP3712
NQF Level	7
NQF Credits	16
Assessment	Continuous Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	CIT3632 Telecommunications and CIT3612 Computer Networks II

Course Content: Security Implementation: Secure Protocols. Digital Certificate and Signature. Use my SQL. Oracle & Data Base (Link three Tables in Data Base). ASP Techniques- PHP Techniques.Packet Switching – HTTP- URL.Basic Internet Tools.Using FTP.The Domain Name Systems.The internet Protocol Suite.

COS3732 OPERATING SYSTEMS

Course Title:	**Operating Systems**
Course Code	COS3732
NQF Level	7
Contact Hours	4 lecture periods per week and one practical session every week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CIT3652 Computer Organization and Architecture & COS3612 Object oriented programming II
Co-requisite	COS3711 Data Structures and Algorithms

Course Description: This course introduces the student to the concepts that underlie Operating Systems (OS).It is essential for a computer scientist to know what operating systems are,what they do and how they are designed.

The course will cover the following topics: Processes in OS, synchronization, Interprocess communication, scheduling, deadlocks, memory management, virtual memory, secondary storage, device management and security.

COS3712 HUMAN COMPUTER INTERACTION

Course Title	**Human Computer Interaction**
Course Code	COS3712
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite	COS3612 Object Oriented Programming II
Co-requisite	CMP3731 Software Engineering

Course Description:This course covers the following topics: Human Aspects of HCI; Guidelines, Principles and Theories of HCI; Usability of Interactive Systems; Interaction Styles; Models and metaphors; Managing the Design Process; predictive and heuristic evaluation of interfaces; HCI with non-traditional interfaces(vision-based interaction, multimodal interaction, ubiquitous computing, augmented and virtual reality, interaction in gaming, mobile interaction);Current Research trends :ubiquitous and context-aware computing; tangible interfaces; haptic interaction; and mobile interfaces.

CMP3752 RESEARCH METHODOLOGY

Course Title	**Research Methodology**
Course Code	CMP3752
NQF Level	7
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Assessment	Continuous Assessment 50%; Examination 50% (1 x 3 hour paper)
Pre-requisite	STS3522 Introduction to Statistics
Co-Requisite:	COS3612 Object Oriented Programming II

Course Description: The nature and need for research in science; scientific method; historic overview of research driven scientific progress; research methods and design; qualitative and quantitative research methods; experimental, quasi-experimental and non-experimental methods; selection of research topics ; writing a research proposal; conducting a literature review; sampling methods; design of questionnaires; interviews and observation techniques; independent and dependent variables; correlation and causation; validity of conclusions;' statistical methods of data evaluation and data analysis; methods of presenting data and conclusions; report writing; ethical considerations in research.

CMP3772 WEB DESIGN AND PROGRAMMING

Course Title	**Web Design and Programming**
Course Code	CMP3772
NQF Level	7
Contact Hours	4 lecture periods per week and one practical session every week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	COS3612 Object Oriented Programming II and COS3632 Advanced Databases

Course Description: XML; DTD; XML Namespaces; Cascading Style Sheets; Client-Side Programming; Document Object Model (DOM); Server-Side Programming with PHP; server-side backend databases; pattern matching with regular expressions; Ajax; JpGraph; JSON; PHP's image functions; PHP's JSON functions; Web Security; JavaScript Libraries; Pseudo-Classes; client-Side Scripts; Traversing the DOM Tree; PHP; enterprise Web development; web applications; web services; web service description language (WSDL); Simple Object Access Protocol (SOAP); UDDI; 3rd party packages; extensive style sheet language (XSL); XSL transformation (XSLT);XMLT; XML parsers.

FOURTH YEAR COURSES

CMP3810 RESEARCH PROJECT

Course Title:	**Research Project**
Course Code	CMP3810
NQF Level	8
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	32
Assessment	Continuous Assessments100%
Pre-requisite	Pass All Third Year Courses

Course Content: This course provides the framework for the development of the necessary research skills through the completion of a supervised research project in the context of the major. Students will be expected to develop a research proposal under the guidance of the supervisor, present the proposal in the written and oral form, collect and analyze relevant data in order to prepare a requirements document, prepare the relevant design documentation for the project, produce workable software, test the software and implement it. The student is expected to produce a report on the project according to the accepted format adopted by the Department of computer Science. The student is expected to present the final report orally and in the written form.

CMP3821 NETWORK SYSTEM SECURITY

Course Title	**Network System Security**
Course Code	CMP3821
NQF Level	8
NQF Credits	8
Contact Hours	2 lecture periods per week and 1 practical session every second week for one semester
Assessment	Continuous Assessement 50%, Examination 50% (1 x 2 hour paper)
Pre-requisite	CIT3712 Computer Networks II & (COS3731 Emerging Technologies OR CIT3711Advanced Computer Networks)

Course Description: Security services, digital signature, key management, network security: IPsec, SSL/TLS, PGP, VPN, firewalls and intrusion detection systems. Cryptography: symmetric, asymmetric and digital signature. email security: SMIME. Malware: viruses, worms, Trojan horses, spy ware, rootkit and dishonest adware. security in wireless and Ad-hoc networks, Secure remote access, electronic payment, web security.

CMP3841 WIRELESS AND MOBILE COMPUTING

Course Title	**Wireless and Mobile Computing**
Course Code	CMP3841
NQF Level	8
Contact Hours	2 lecture periods per week and 1 practical session every second week for one semester

NQF Credits 8
Assessment Continuous Assessment 50%, Examination 50% (1 x 2 hour paper)
Pre-requisite (COS3712 Human Computer Interaction & COS3731 Emerging Technologies) OR (CIT3711Advanced Computer Networks & CIT3712 Internet Technolgies and Applications)

Course Description: Wireless networks; cellular systems; medium access techniques; radio propagation models; power control and error control techniques; hard and soft handoffs; protocols(AMPS, IS-95, IS-136); radio resources and network management; wireless antennas ; wireless propagation; wireless local loop(WLL); integrated architectures for mobile services; mobile transmission; network performance and traffic engineering; wireless security.

COS3871 ARTIFICIAL INTELLIGENCE

Course Title	**Artificial Intelligence**
Course Code	COS3871
NQF Level	8
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CMP3512 Programming Fundamentals II, COS3612 Object Oriented programming II & CIT3631 Discrete mathematics Concept OR CMP3711 Computer Theory

Course Description: The course will cover the following topics: -Introduction to AI; Major components in a typical intelligent system, Flavours of AI; Church-Turing thesis, The Turing test, Searle's Chinese room argument; Introduction to PROLOG, The PROLOG Language, PROLOG in AI; Search: Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill-climbing search. Optimisation and search such as stochastic annealing and genetic algorithm; dynamic programming, A*; Representing Knowledge: Production rules, monotonic and non-monotonic logics, description logics; Reasoning and Control: Data-driven and goal-driven reasoning, AND/OR graphs; Reasoning under Uncertainty: Probabilities, conditional independence, causality, Bayesian networks; Machine Learning: Inductive and deductive learning, unsupervised and supervised learning, reinforcement learning, concept learning from examples, Quinlan's ID3, classification and regression trees, Bayesian methods.

CMP3832 ENTREPRENEURSHIP AND MANAGEMENT OF IT SYSTEMS

Course Title	**Entrepreneurship & Management of IT Systems**
Course Code	CMP3832
NQF Level	8
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
NQF Credits	16
Assessment	Continuous Assessment 50%, Examination 50% (1 x 3 hour paper)
Pre-requisite	COS3712 Human Computer Interaction

Course Content: Definitions of Entrepreneurship; entrepreneurial mind; starting a new business; home based businesses; overview of challenges of SME's; Namibian context and entrepreneurial action; legal and accounting concerns; Business plans; economic characteristics; Critical success factors; evaluation processes and feasibility study; entrepreneurial team; Social entrepreneurship, ethics and strategic planning and franchising; management of IT Systems(Making a strategic case for IT systems, historical Development of IT systems, Information Management, Managers views); strategic management of IT system(sector management of IT systems A Framework for Management of IT Systems); Information technology and Strategic advantage(formulating Information Systems Strategy, formulating IT strategy. Formulation Information management Strategy); Organizing IT activities:(controlling IT activities, Financing IT, appraising IT and Responsibility Accounting for IT);evaluation IT; Integrating IT and Organization.

CMP3821 NETWORK SECURITY

Course Title	**Network Security**
Course Code	CMP3821
NQF Level	8
Contact Hours	2 lecture periods per week and one practical session every second week for one semester
NQF Credits	8
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite	CIT3612 Computer Networks II & COS3731Emerging Technologies OR CIT3711 Advanced Computer Networks

Course Description: Security services, digital signature, key management, network security: IPSec, SSL/TLS, PGP, VPN, firewalls and intrusion detection systems. Cryptography: symmetric, asymmetric and digital signature. email security:
Course Title: Numerical Methods and Operations Research
SMIME. Malware: viruses, worms, Trojan horses, spy ware, rootkit and dishonest adware. security in wireless and Ad-hoc networks, Secure remote access, electronic payment, web security.

CMP3811 NUMERICAL METHODS AND OPERATIONS RESEARCH

Course Title	**Numerical Methods & Operations Research**
Course Code	CMP3811
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CMP3651 Mathematics of Computer Science

Course Description: Introduction to Model Building; Graphical Solution of Linear Programming Problems; Simplex Algorithm; Goal Programming; Nonlinear Programming; NLPs; Decision Making; Theory and Framing; Game Theory;

Probabilistic Inventory Models; Stochastic Processes; Markov Chains; Deterministic Dynamic Programming; Queuing Theory; Discrete-Event Simulation; Random Numbers and Monte Carlo Simulation; Simulation with Continuous Random Variables; Statistical Analysis in Simulations; Simulation; Time Series Models; exponential Smoothing with Season; Ad Hoc Forecasting; Regression; Operations Research Packages; Simulation with SIMULA; operations research with packages.

CMP3851DISTRIBUTED SYSTEMS

Course Title	**Distributed Systems**
Course Code	CMP3851
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite	CIT3612 Computer Networks II & COS3711 Data Structure and Algorithms

Course Description: Distributed systems architectures; Inter-process communications; RPC; multithreaded processes; client-server communication; server structures; concurrent and distributed programming; caching; coherence; protocols; name service; reliability and availability; recovery techniques, distribution and duplication; fault management; distributed algorithms; synchronization; distributed coordination; Peer-to-peer; clusters and grid; security; research issues with key application areas will be selected from: enterprise computing systems; GRIDS; Clouds; B2B integration; Infrastructure.

CMP3812 REAL TIME MULTIMEDIA

Course Title	**Real Time Multimedia**
Course Code	CMP3812
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Compulsory/Elective	Elective
Pre-requisite	(CIT3611 Computer Networks I, CIT3612 Computer networks II & COS3731 Emerging

Technologies) OR (CIT3611 Computer Networks I, CIT3612 Computer networks II and CMP3712 Internet Technologies & Applications)
Course Description: Session Initiation Protocol (Sip). Streaming multimedia; digital multimedia; interactive multimedia; video/speech/data conferencing; Transmission of Real-Time Multimedia in Packet Networks Using RTP/RTCP; Softswitches; Asterisk; Voice/Video over IP; IPTV; compression techniques; convergence.

CMP3832 ENTREPRENEURSHIP AND MANAGEMENT OF IT SYSTEMS

Course Title	**Entrepreneurship And Management of IT systems**
Course Code	CMP3832
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Pre-requisite	COS3712 Human Computer Interaction

Course Description: Definitions of Entrepreneurship; entrepreneurial mind; starting a new business; home based businesses ;overview of challenges of SME's; Namibian context and entrepreneurial action; legal and accounting concerns; Business plans; economic characteristics; Critical success factors; evaluation processes and feasibility study; entrepreneurial team; Social entrepreneurship, ethics and strategic planning and franchising; management of IT Systems(Making a strategic case for IT systems, historical Development of IT systems, Information Management, Managers views); strategic management of IT system(sector management of IT systems A Framework for Management of IT Systems); Information technology and Strategic advantage(formulating Information Systems Strategy, formulating IT strategy. Formulation Information management Strategy); Organizing IT activities:(controlling IT activities, Financing IT, appraising IT and Responsibility Accounting for IT);evaluation IT; Integrating IT and Organization.

CMP3872 DATABASE PROGRAMMING

Course Title	**Database Programming**
Course Code	CMP3872
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	CMP3772 Web Design & Programming, COS3632 Advance Databases & COS3612 Object Oriented Programming II

Course Description: Database concepts; advanced database transaction management/models; database architecture; multilevel transactions; dynamically restructured transactions; workflow models; properties of transaction; sagas; serializability and recovery; serial and nonserial schedules; locking methods; times-tamping methods; thomas's write rule; object data standard; object store; common gateway interface (CGI); web-database platform; web-DBMS integration; web-DBMS approach; scripting languages; hypertext transfer protocol; web server; components; containers; container-Managed persistence; persistent classes; remote data services; common language runtime; open database connectivity; object-relational DBMS; privileges; query processing; relational algebra tree.

COS3812 DATA WAREHOUSING & DATA MINING

Course Title:	**Data Warehousing & Data Mining**
Course Code	COS3812
NQF Level	8
Contact Hours	4 lecture periods per week and one practical session every week for one semester
NQF Credits	16
Course Assessment	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) Examinations 50%
Prerequisite	COS3632 Advanced Databases and COS3711 Data Structures and Algorithms

Course Content: Data warehouse; Data models; architecture; relational and multidimensional OLAP; implementing data Warehouses(data extraction, cleansing, transformation and loading, data cube computation, materialized view selection); OLAP query processing; data Mining Fundamentals (data mining process and system architecture, relationship with data warehouse and OLAP systems); mining Techniques and Application(association rules, mining spatial databases, mining multimedia databases, web mining , mining sequence and time-series data and text mining and data pre-processing).

F.6. ARTICULATION PROGRAMME FOR COMPUTER SCIENCE

F.6.1. CRITERIA FOR ADMISSION

1) The applicant must be in possession of EITHER

a) a BSc degree in Computer Science or related qualification at NQF level 7.
b) OR
c) a pre-NQF BSc degree in Computer Science or equivalent qualification from a recognized institution.

2) Students who have completed a double major Bachelor of Science degree in which one of the majors was Computer Science or Information Technology may be required to register for a number of undergraduate modules for non-degree purposes in order to gain admission into this programme.

F.6.2. ARTICULATION OPTIONS

This qualification may serve as an entry point to an MSc degree in Information Technology.

F.6.3. MODE OF DELIVERY

The programme is offered on a full-time basis only on the Main Campus of UNAM.

F.6.4. DURATION OF STUDY

The minimum duration of the study is one year and the maximum duration is two years.

F.6.5 ASSESSMENT CRITERIA

A candidate will be eligible to write the final examination if he/she has obtained the required continuous assessment (CA) mark of 40%. A combination of continuous assessment (50%) and an examination (50%) will be used to assess each of the typical modules in this programme and details are further specified under respective module descriptors. Assessment criteria are based on written examinations, written tests, assignments, research reports, oral examinations, and seminar presentations. Attendance of lectures and tutorial classes is compulsory (at least 80%).

F.6.6. MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE FACULTY

To be re-admitted to the Faculty of Science for a second year of registration, a student must have passed a minimum of 64 credits by the end of the first year.

SUMMARY TABLE FOR ALL MODULES IN THE PROGRAMME

Year 1

CODE	COURSE NAME	NQF LEVEL	CREDITS	CONTACT TIME	Co-requisite / PREREQUISITES
Semester 1					
CMP3821	Network System Security	8	8	2 L +0.5 P / week	
CMP3841	Wireless and Mobile Computing	8	8	2 L +0.5 P / week	
Choose any Two of the following courses:					
CMP3811	Numerical Methods and Operations Research	8	16	4 L+ 1 P / week	
CMP3851	Distributed Systems	8	16	4 L+ 1 P / week	
COS3871	Artificial Intelligence	8	16	4 L+ 1 P / week	
Total Credits Semester 1					48
COS3812	Data warehousing & Data Mining	8	16	4 L+ 1 P / week	
Choose any TWO of the following courses:					
CMP3832	Entrepreneurship and Management of IT Systems	8	16	4 L+ 1 P / week	
CMP3812	Real Time Multimedia	8	16	4 L+ 1 P / week	
CMP3872	Database Programming	8	16	4 L+ 1 P / week	
Total Credits Semester 2					48
Semester 1 & 2					
CMP3880	Research Methodology & Project	8	38	Fortnightly meetings with supervisor	
		TOTAL CREDITS FOR THE PROGRAMME			134

All co- and pre-requisites as indicated in the curriculum framework and the module descriptors in this programme are superseded by the admission requirements indicated under point F.5

F.6.6.1. COMPUTING COURSE EQUIVALENTS

OLD MODULES	NEW MODULES
CMP3511 Programming Fundamentals I	CMP3511 Programming Fundamentals I
CMP3512 Programming Fundamentals II	CMP3512 Programming Fundamentals II
CMP3521 Fundamentals of Digital Electronics	CMP3531 Introductions to Digital Electronics
CMP3532 Computer Organization	No exact equivalence. To be repeated.
CME3512 Introduction to Web Design	CIT3512 Fundamentals of Information Technology II
CME3511 Introduction to Information Technology	CIT3511 Fundamentals of Information Technology I
CMP3641 Software Engineering I	CIT3611 Computer Networks I
CMP3611 Introduction to Database Systems	CMP3611 Introduction to Database Systems
CMP3622 Advances Databases	COS3632 Advanced Databases
CMP3671 Mathematics for Computer Science I	CMP3651 Mathematics for Computer Science
CMP3672 Mathematics for Computer Science II	No exact equivalence. To be repeated.
CMP3631 Object Oriented Programming	COS3611 Object Oriented Programming I
CMP3691 Object Oriented Programming I	COS3611 Object Oriented Programming I
CMP3692 Object Oriented Programming	COS3612 Object Oriented Programming II
CME 3611 Telecommunications	CIT3632 Telecommunications
CMP3632 Foundations of Data Communications	CIT3652 Computer Organization and Architecture
CME3612 Networking and Emerging Technologies	No exact equivalence. To be repeated.
CMP3652 Software Engineering II	CIT3612 Computer Networks II
CMP3612 Data Structures and Algorithms	COS3612 Object Oriented Programming II
CMP3701 Research Methodology I	No exact equivalence. To be repeated.
CMP3721 Computer Networks	CIT3711 Advanced Computer Networks
CMP3741 Computer Theory	CMP3711 Computer Theory
CMP3761 Computer Architecture	CIT3771 System Administration and Maintenance
CMP3771 Artificial Intelligence	No exact equivalence. To be repeated.
CME3731 Introduction to Network Security	CIT3731 Information Security
CMP3702 Research Methodology II	CMP3752 Research Methodology
CMP3712 Internet Technologies and Applications	CMP3712 Internet Technologies and Applications
CMP3742 Human Computer Interaction and Computer Eth	COS3712 Human Computer Interaction
CMP3762 Computer Graphics	SCIT3732 Platform Technologies
CMP3722 Operating Systems	COS3732 Operating Systems
CME3732 Advanced Web Programming	CMP3772 Web Design And Programming
CMP3819 Software Project Management	CMP3819 Software Project Management
CMP3831Operations Research	CMP3811 Numerical Methods and Operations Research
CMP3802 Field Attachment	CMP3832 Entrepreneurship and Management of IT Systems
CMP3821 Network Systems Security	CMP3821 Network Systems Security
CMP3841 Wireless and Mobile Computing	CMP3841 Wireless and Mobile Computing
CMP3822 Data Warehousing and Data Mining	COS3812 Data Warehousing & Data Mining
CMP3812 Real Time Multimedia	CMP3812 Real Time Multimedia
CMP3872 Database Programming	CMP3872 Database Programming

No exact equivalence. To be repeated offered in for repeaters

F.7. M.Sc. INFORMATION TECHNOLOGY (IT) PROGRAMME (22MSCI)

F.7.1. ADMISSION REQUIREMENTS

The applicants will be accepted on the basis of their undergraduate records. The Master of Science in Information Technology programme is open to all Bachelor's degree holders with Computer Science major or Computer related field and with a minimum average pass mark of 60%.

F.7.2. DURATION OF STUDY

The Master of Science in Information Technology is offered through coursework and thesis, extending over two years for full-time students and three years for part-time students. The coursework is conducted during the first academic year of study and is followed by a supervised original research project extending over the second year.

F.7.3. CURRICULUM COMPILATION

The curriculum for the MSc. degree consists of the writing of a research thesis. Refer to the Regulations for Postgraduate Courses of Study in the General Prospectus: Information, Regulations& Fees.

F.7.4. EXAMINATION REGULATIONS

Formal examination will take place at the end of each semester. Examinations will be subject to external assessment. The candidate should pass the formal examinations in the taught courses before registering for the Thesis Course. A candidate who fails any part of his/her Masters Degree Programme and who is allowed to repeat that part may be exempted by Senate, on the recommendations of the Departmental panel of examiners from those courses or components from that part s/he passed.

F.7.5. FORMAT AND EVALUATION OF THESIS WORK

A candidate shall be required to submit a complete report in loose bound form for verification and approval to the concerned supervisors in the following format: Paper size: A4 (International format, 210 x 297 mm) Line space:1.5 Top and Bottom margins: 20mm Left margin: 30mm Right margin: 10 mm Figures/flowchart/circuits/block diagrams: No restrictions. Font size: 12 After the dissertation has been approved by the panel the candidate shall submit at least four bounded copies with the chairman of the department in accordance with the following specifications: Color of the report: White Type of binding: Artvellum or cloth Front page should include: University Logo Title of the Project Title of the Degree Name of the candidate Month and Year The relevant department will retain one copy and two copies will be deposited in the university Library. Unless senate has agreed to the contrary the Library copies shall be open to public reference. One copy to the supervisor. The candidate should submit the completed project work in all respects before the end of the academic calendar as announced by the respective department. The candidates will be informed in advance the date, time and the venue of the viva-voce examination. Other regulations and guidelines are same shown in the section (9.4.7) page no. 28 of the general prospectus 2002 are holds good. Concept and Evaluation of Mini Project: Concept of mini project is introduced in each course in order to strengthen the programming skills and ideas to develop the real time project as the time goes. It not only gives the skills but also gives the confidence in the candidates to go ahead with the project developments and practical implementations with different types of tools. The evaluation will be done by a group of examiners constituted by the course co-ordinator. The candidate has to submit a complete project report according to the format given by the respective supervisors. Evaluation also involves the demonstration and viva-voce.

F.7.6. PRACTICALS

Attendance of practical classes is compulsory.

NB: STUDENT MUST PASS ALL COURSES/COURSES AND PRE/CO-REQUISITES AS LISTED FOR THE PARTICULAR COURSES. THIS SECTION LISTS ALL THE COURSE CODES FOR MSC (IT), FOLLOWED THEREAFTER BY THE COURSE CONTENTS IN THE SAME ORDER.

QUALIFICATION: MSC. INFORMATION TECHNOLOGY (IT) PROGRAMME (22MSCI)

F.7.7. COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

YEAR 1

CODE	COURSE NAME	NQF Level	CREDIT	PRE-REQUISITES	CO-REQUISITES
Semester 1					
UAE5819	Academic Writing for Post Graduate Students	9	16	Must be a Postgraduate student	None
CMP5931	Discrete Mathematics	9	16	None	None
CMP5951	Computer Graphics	9	16	None	None
CMP5971	Advanced Operating Systems		16	None	None
Semester 2					
CMP5912	Cryptography and Network Security	9	16	None	None
CMP5932	Research Methodology and Research Proposal	9	16	None	None
CMP5952	AdvancedSoftware Engineering	9	16	None	None
CMP5972	Data Communication and Computer Networks	9	16	None	None
Total Credit			128		

YEAR 2

CODE	COURSE NAME	NQF Level	CREDIT	PRE-REQUISITES	CO-REQUISITES
CMP5900	Thesis	9	120	Passed ALL first year courses	None
Total Credit			120		

F.7.8. MASTER OF SCIENCE INFORMATION TECHNOLOGY (IT) COURSE DESCRIPTIONS

FIRST YEAR COURSES

UAE5819 ACADEMIC WRITING FOR POST GRADUATE STUDENTS

Course title: **ACADEMIC WRITING FOR POST GRADUATE STUDENTS**
Code: UAE5819
NQF level: 9
Contact hours: 56 hours theory (4 hours per week for one semester)
Credits: 16
Course Assessment Examination: Continuous Assessment: 50% (critical reading assignment, annotated bibliography, term paper). 50% (1 x 3 hour exam)
Prerequisites: Must be a Masters or PHD student

Course Description: This course is a post-graduate course designed to empower students with skills and knowledge to access and critique academic sources and to synthesize information from these sources to assist them in the substantiation and development of their own claims when writing an academic paper in their respective fields of specialization. Additionally, this course will empower students with the capacity to undertake the challenges of academic writing by exposing them to the different rhetorical and stylistic elements typical of academic texts. Finally, students will be introduced to the American Psychological Association (APA) writing style and will be equipped with the necessary skills to format an academic paper in APA style.

CMP5931 DISCRETE MATHEMATICS

Course title: **DISCRETE MATHEMATICS**
Code: CMP5931
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 24
Course Assessment: Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) and Examinations 50%
Prerequisites: None

Course Description: To extend student's mathematical ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems. The concepts and notations from discrete mathematics are useful to study or describe objects or problems in computer algorithms and programming languages. Content: Discrete models, Concepts of sets and functions, foundations, finite series logic, propositional logic, predicate logic, principles of counting, permutations and combinations, induction and recursion, Concepts of AI

CMP5951 COMPUTER GRAPHICS

Course title: **COMPUTER GRAPHICS**
Code: CMP5951
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 24
Course Assessment Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) and Examinations 50%
Prerequisites: None

Course description: Computer graphics have revolutionalized movie and printing techniques, improved human-computer interfaces, and drive new applications such as computerized photography, art, games, simulations, and mechanical design.

Content: Overview of graphics systems, OpenGL, output primitives, attributes of output primitives, two dimensional geometric transformations and viewing, graphical user interfaces and Interactive input methods, three dimensional concepts, three dimensional object representations, computer animation, color models and color applications.

CMP5971 ADVANCED OPERATING SYSTEMS

Course title: **ADVANCED OPERATING SYSTEMS**
Code: CMP5971
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 24
Course Assessment: Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) and Examinations 50%
Prerequisites: None

Course description: Thecourse equips studentswith the knowledge of managing different operating systems

Content: Different types of OS, Operating System Structures, Process Management: Threads, CPU Scheduling, Process Synchronization, Deadlocks, Memory Management: Main Memory, Virtual Memory, Storage Management, Protection and Security, Distributed Systems.

CMP5912 CRYPTOGRAPHY AND NETWORK SECURITY

Course title: **CRYPTOGRAPHY AND NETWORK SECURITY**
Code: CMP5912
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 24
Course Assessment Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) and Examinations 50%
Prerequisites: None

Course description: Deals with the main security threats to communications networks such as X-25, Internet, mobile communications, broadband, local area networks and wide area networks. The course establishes certain security mechanisms that avoid or diminish the threats. It introduces students to specific cryptographic techniques that guarantee security in certain applications: e-mail, e-commerce, and web access.

Content: Introduction: OSI security architecture, classical encryption techniques, cipher principles, evaluation criteria foe AES-AES cipher, triple DES. Public key cryptography: key management, Diffie-Hellman key exchange, number theory, confidentiality using symmetric encryption, and RSA. Message authentication and hash function: message authentication codes, security of hash functions and MACs, MD5 message digest algorithm, secure hash algorithm, authentication protocols, and digital signature standards. Network security: Kerberos, X.509 authentication service, electronic mail, security, PGP, S/MIME, IP security, and web security. System level security: intrusion detection, password management, viruses, worms, firewalls.

CMP5932 RESEARCH METHODOLOGY AND RESEARCH PROPOSAL

Course title: **RESEARCH METHODOLOGY AND RESEARCH PROPOSAL**
Code: CMP5932
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 24
Course Assessment 100% Continuous Assessment
Prerequisites: None

Course description: This course introduces the student to Postgraduate research. It aims to ensure that candidates are able to design and formulate appropriate postgraduate research projects, as well as to present their work, in preparation for the course CMP5900, Thesis. The course focuses on topics that are crucial to writing research proposals, conducting research, and preparation of theses. Candidates will be expected to do a number of presentations, which will enable them to develop confidence in presenting research results and to think carefully about the research approaches and methodologies that they adopted.

Content: Research Skills – search skills, writing skills, presentation skills; Conducting literature review; Research methodology; Research techniques; Developing research instruments; Carrying out research; Analysis of research results; presentation of results; validity of conclusions.

CMP5952 ADVANCED SOFTWARE ENGINEERING

Course title: **ADVANCED SOFTWARE ENGINEERING**
Code: CMP5952
NQF level: 9
Contact hours: 42 lecture hours and 36 hours of practical sessions
Credits: 24
Course Assessment Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) and Examinations 50%
Prerequisites: None

Course description: The course equips students with the knowledge of designing and building workable software systems

Content: Software – the process and its management, project management: software metrics, estimation, planning, system and software requirement analysis; Computer System analysis, analysis fundamentals, structured analysis, object oriented analysis and data modeling, design and implementation of software, ensuring, verifying and maintaining software integrity; the role of automation.

CMP5972 DATA COMMUNICATION AND COMPUTER NETWORKS

Course title:	**DATA COMMUNICATION AND COMPUTER NETWORKS**
Code:	CMP5972
NQF level:	9
Contact hours:	42 lecture hours and 36 hours of practical sessions
Credits:	24
Course Assessment:	Continuous Assessment 50% (Minimum of 2 tests and 2 assignments) and Examinations 50%
Prerequisites:	None

Course description: The course is designed to provide the computer candidates with a working knowledge of data communications, computer networks and open systems. The course includes basic terminology and concepts in data communications, telecommunication protocols, transmission techniques and computer network architecture alternatives.

Content: Introduction to data communications, fundamentals of communications, data transmission coding and framing, data switching, hardware media and network software, reference models, network standardization, complete study of OSI reference models, designing.

SECOND YEAR COURSE

CMP5900 THESIS

Course title:	**THESIS**
Code:	CMP5900
NQF level:	9
Contact hours:	Weekly meetings, the frequency of which may be agreed with supervisors
Credits:	120

Course Assessment: 100% A comprehensive research proposal is to be submitted to senate through the Faculty. In addition, every candidate shall submit a thesis in accordance with the guidelines stipulated in the Postgraduate Student Guide, to be examined by at least two specialists approved by Senate. At least one of these specialists must be external to UNAM.

Prerequisites: Successful completion of all the Courses in the first year of study

Course description/ Content: Each candidate shall undertake a research project during the year, supervised by an approved supervisor. The research topic may come from the current ICT/Telecommunication technological challenges, in view to provide solutions. Candidates must submit periodic written reports about the research findings to their supervisors, and hold regular discussions with their supervisors. Candidates are also required to participate in research seminars where they present any breakthroughs made in the research for the benefit and input from other scholars.

F.8. MATHEMATICS

F.8.1. DEPARTMENTAL REGULATIONS

To register for a B.Sc. in Mathematics Honours, a candidate needs to have obtained at least a C-symbol in NSSC Mathematics. To register for a B.Sc. in Financial Mathematics Honours, a candidate needs to have obtained at least a B-symbol in NSSC Mathematics. English is a compulsory subject and should normally have been obtained as a Second Language at NSSC (O level) with a minimum C symbol or English as a First Language at NSSC (O level) with a minimum D symbol. In addition, a minimum C symbol in Physical Science is required for a candidate choosing the Physics Stream.

A candidate should obtain a minimum of 25 points on the UNAM Evaluation Point Scale in his/her five (5) best subjects (of which Mathematics and English must be included) to be admitted to undergraduate studies (Refer to the General Admission Criteria for Undergraduate Programmes in the General Information and Regulations Yearbook). Obtaining the minimum number of points, however, does not necessarily ensure admission. Admission is based on places available in courses, subjects and programmes and is awarded on the basis of merit.

F.8.1.1. DURATION OF STUDY (BSc. Hons Mathematics & BSc. Hons Financial Mathematics)

A student should be able to complete these programmes in a minimum of four (4) years.

F.8.1.2. ASSESSMENT CRITERIA

A combination of continuous assessment (50%) and an examination (50%) will be used to assess each of the typical courses in this programme. Continuous assessment will consist of a subset of the following, depending on the course needs: class tests, assignments (in the form of reports), seminar presentations and research projects.

F.8.1.3. MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE DEPARTMENT/FACULTY

To be re-admitted into the faculty for a particular year of registration, a student must have passed the minimum number of courses as indicated below:

- **4 courses** (equivalent to **64 credits**) by the end of the **first year**; 2 of these courses (equivalent to **32 credits**) must be **non-core,**
- **8 courses** (equivalent to **144 credits**) by the end of the **second year**,
- **15 courses** (equivalent to **240 credits** by the end of the **third year**, and
- **23 courses** (equivalent to **368 credits**) by the end of the **fourth year**.

F.8.1.4. ADVANCEMENT AND PROGRESSION RULES

A student advances to when at least 2/3 of the courses of the curriculum for a specific year have been passed. If a student passed only 1/3 of the full curriculum of a specific year, he/she may not register for any courses of the following year. In all cases, prerequisites for courses have to be passed before a student can proceed to register for such courses.

- From year **1** to **2**: <u>At least</u> <u>7 courses</u> (equivalent to **112 credits**) prescribed for **year 1.**
- From year **2** to **3**: <u>All first-year courses</u> plus at least **6 courses** (equivalent to **96 credits**) prescribed for **year 2**.
- From year **3** to **4**: <u>All second-year courses</u> plus at least **5 courses** (equivalent to **80 credits**) prescribed for **year 3**.

F.8.1.5. MAXIMUM NUMBER OF COURSES THAT MAY BE TAKEN PER YEAR

A student may not take more than the equivalent of 12 full courses per year.

F.8.1.6. REQUIREMENTS FOR AWARD OF QUALIFICATION

This qualification will be awarded to candidates credited with a minimum of **544 credits** - out of which **48** are from UNAM core courses, **368** are from Mathematics courses and **112** from elective courses from **Physics, Computer Science or Statistics (the actual numbers depending on the stream** chosen).

F.8.2. BACHELOR OF SCIENCE IN MATHEMATICS HONOURS

The design of the BSc in Mathematics Honours programme incorpotes a major in Mathematics and electives from **Physics, or Computer Science or Statistics**.

F.8.2.1.MATHEMATICS HONOURS, ELECTIVES, CURRICULUM AND PREREQUISITES

F.8.2.1.1. QUALIFICATION: Bachelor of Science in Mathematics Honours PHYSICS STREAM

Students opting for Physics stream must take all of the following courses: **11BSCM**

YEAR 1

COURSE CODE	COURSE / NAME	NQF Level	CREDITS	PREREQUISITES	CO-REQUISITES
YEAR 1 SEMESTER 1					
LCE3419	English Communication & Study Skills	4	16		None
MAT3511	Basic Mathematics	5	16		None
CLC3509	Computer Literacy	5	8		None
MAT3501	Analytic Geometry	5	8		None
MAT3521	Matrices and Complex Numbers	5	8		None
PHY3511	Physics for Physical Sciences I	5	16		None
YEAR 1 SEMESTER 2					
LEA3519	English for Academic Purposes	5	16		None
CSI3580	Contemporary Social Issues	5	8		None
STS3532	Introduction to Probability	5	16		None
MAT3512	Precalculus	5	16		None
PHY3512	Physics for Physical Sciences II	5	16		PHY3511
Total Credit			144		

YEAR 2

COURSE CODE	COURSE / NAME	NQF Level	CREDITS	PREREQUISITES	CO-REQUISITES
YEAR 2 SEMESTER 1					
MAT3611	Calculus I	6	16	MAT3512	None
MAT3661	Sets and Logic	6	8	MAT3511	None
MAT3641	Numerical Methods with MATLAB	6	8	MAT3521	None
PHY3601	Optics	6	8	PHY3512 & MAT3512	None
PHY3651	Mechanics and Waves	6	16	PHY3511 & MAT3512	None
STS3611	Probability Theory	6	16	STS3532 and MAT3512	None
YEAR 2 SEMESTER 2					
MAT3612	Calculus II	6	16	MAT3512	None
MAT3652	Elementary Linear Algebra	6	16	MAT3511or MAT3512 and MAT3521	None
MAT3642	Ordinary Differential Equations	6	8	MAT3521 & MAT3512	None
PHY3612	Electromagnetism	6	16	PHY3512 & MAT3512	None
PHY3622	Electronics	6	8	PHY3512 & MAT3512	None
Total Credit			136		

YEAR 3

COURSE CODE	COURSE / NAME	NQF Level	CREDITS	PREREQUISITES	CO-REQUISITES
YEAR 3 SEMESTER 1					
MAT3731	Real Analysis I	7	16	MAT3611 and MAT3612	None
MAT3711	Linear Algebra I	7	16	(MAT3611 or MAT3612) & MAT3661 & MAT3652	None
MAT3701	Numerical Analysis I	7	8	(MAT3611 or MAT3612) and MAT3641	None
MAT3781	Elements of Set Theory	7	8	(MAT3611 or MAT3612) and MAT3661	None
MAT3761	Research Methodology	7	8	MAT3661	None
PHY3711	Electrodynamics	7	16	PHY3612 and MAT3612	None
YEAR 3 SEMESTER 2					
MAT3732	Real Analysis II	7	16	MAT3611 and MAT3612	None
MAT3712	Linear Algebra II	7	16	(MAT3611 or MAT3612) & MAT3661 and MAT3652	None
MAT3742	Vector Analysis	7	8	MAT3611 and MAT3612	None
MAT3722	Number Theory	7	8	(MAT3611 or MAT 3612) and MAT 3661	None
MAT3752	Partial Differential Equations	7	16	(MAT3611 or MAT3612) and MAT3642	None
Total Credit			136		

YEAR 4

COURSE CODE	COURSE / NAME	NQF Level	CREDITS	PREREQUISITES	CO-REQUISITES
YEAR 4 SEMESTER 1					
MAT3810	Research Project	8	32	All mathematics courses up to Year 3	None
MAT3811	General Topology	8	16	MAT3731 or MAT3732	None
MAT3871	Numerical Analysis II	8	16	MAT3701 or MAT3732	None
MAT3851	Complex Analysis I	8	16	MAT3731 or MAT3732	None
YEAR 4 SEMESTER 2					
MAT3822	Normed Vector Spaces	8	8	(MAT3731 or MAT3732) and (MAT3711 or MAT3712)	None
MAT3802	Category Theory	8	8	MAT3781	None
MAT3872	Algebra	8	16	MAT3711 or MAT3712	None
MAT3852	Complex Analysis II	8	16	MAT3731 or MAT3732	None
Total Credit			128		

F.8.2.1.2. QUALIFICATION: Bachelor of Science in Mathematics Honours: COMPUTER SCIENCE STREAM

Students opting for **Computer Science** Stream must take all of the following courses: **11BSMC**

YEAR 1

COURSE CODE	COURSE / NAME	NQF Level	CREDITS	PREREQUISITES	CO-REQUISITES
YEAR 1 SEMESTER 1					
LCE3419	English Communication & Study Skills	4	16		None
MAT3511	Basic Mathematics	5	16		None
CLC3509	Computer Literacy	5	8		None
MAT3501	Analytic Geometry	5	8		None
MAT3521	Matrices and Complex Numbers	5	8		None
CMP3511	Programming Fundamentals I	5	16		None
YEAR 1 SEMESTER 2					
LEA3519	English for Academic Purposes	5	16		None
CSI3580	Contemporary Social Issues	5	8		None
STS3532	Introduction to Probability	5	16		None
MAT3512	Precalculus	5	16		None
CMP3512	Programming Fundamentals II	5	16		CMP3511
Total Credit			144		

YEAR 2

COURSE CODE	COURSE / NAME	NQF Level	CREDITS	PREREQUISITES	CO-REQUISITES
YEAR 2 SEMESTER 1					
MAT3611	Calculus I	6	16	MAT3512	None
MAT3661	Sets and Logic	6	8	MAT3511	None
MAT3641	Numerical Methods with MATLAB	6	8	MAT3521	None
CMP3611	Introduction to Database Systems	6	16	CMP3512	None
COS3611	Object Oriented Programming I	6	16	CMP3512	None
YEAR 2 SEMESTER 2					
MAT3612	Calculus II	6	16	MAT3512	None
MAT3652	Elementary Linear Algebra	6	16	MAT3511 or MAT3512 & MAT3521	None
MAT3642	Ordinary Differential Equations	6	8	MAT3521&MAT3512	None
COS3632	Advanced Databases	6	16	CMP3511	CMP3611
COS3612	Object Oriented Programming II	6	16	CMP3511& CMP3512	COS3611
Total Credit			136		

YEAR 3

COURSE CODE	COURSE / NAME	NQF Level	CREDITS	PREREQUISITES	CO-REQUISITES
YEAR 3 SEMESTER 1					
MAT3731	Real Analysis I	7	16	MAT3611 and MAT3612	None
MAT3711	Linear Algebra I	7	16	(MAT 3611 or MAT3612) & MAT3661 & MAT3652	None
MAT3701	Numerical Analysis I	7	8	(MAT3611 or MAT3612) and MAT3641	None
MAT3781	Elements of Set Theory	7	8	(MAT3611 or MAT3612) and MAT3661	None
MAT3761	Research Methodology	7	8	MAT3661	None
COS3711	Data Structures and Algorithms	7	16	COS3612	None
YEAR 3 SEMESTER 2					
MAT3732	Real Analysis II	7	16	MAT 3611 and MAT3612	None
MAT3712	Linear Algebra II	7	16	MAT3611 or MAT3612 & MAT3661 &MAT3652	None
MAT3742	Vector Analysis	7	8	MAT3611 and MAT3612	None
MAT3722	Number Theory	7	8	(MAT3611 or MAT3612) and MAT3661	None
MAT3752	Partial Differential Equations	7	16	(MAT3611 or MAT3612) and MAT3642	None
Total Credit			136		

YEAR 4

COURSE CODE	COURSE / NAME	NQF Level	CREDITS	PREREQUISITES	CO-REQUISITES
YEAR 4 SEMESTER 1					
MAT3810	Research Project	8	32	All mathematics courses up to Year 3	None
MAT3811	General Topology	8	16	MAT3731 or MAT3732	None
MAT3871	Numerical Analysis II	8	16	MAT3701 or MAT3732	None
MAT3851	Complex Analysis I	8	16	MAT3731 or MAT3732	None
YEAR 4 SEMESTER 2					
MAT3822	Normed Vector Spaces	8	8	MAT3731 or MAT3732 & (MAT3711 or MAT3712)	None
MAT3802	Category Theory	8	8	MAT3781	None
MAT3872	Algebra	8	16	MAT3711 or MAT3712	None
MAT3852	Complex Analysis II	8	16	MAT3731 or MAT3732	None
Total Credit			128		

F.8.2.1.3. QUALIFICATION: Bachelor of Science in Mathematics Honours: STATISTICS STREAM

Students opting for **Statistics Stream** must take all of the following courses: **11BSMS**

YEAR 1

COURSE CODE	COURSE / NAME	NQF Level	CREDITS	PREREQUISITES	CO-REQUISITES
YEAR 1 SEMESTER 1					
LCE 3419	English Communication & Study Skills	4	16		None
MAT3511	Basic Mathematics	5	16		None
CLC3509	Computer Literacy	5	8		None
MAT3501	Analytic Geometry	5	8		None
MAT3521	Matrices and Complex Numbers	5	8		None
STS3531	Descriptive Statistics	5	16		None
YEAR 1 SEMESTER 2					
LEA3519	English for Academic Purposes	5	16		None
CSI3580	Contemporary Social Issues	5	8		None
STS 3532	Introduction to Probability	5	16		None
MAT3512	Precalculus	5	16		None
MAF3532	Basic Financial Mathematics	5	16		None
Total Credit			144		

YEAR 2

COURSE CODE	COURSE / NAME	NQF Level	CREDITS	PREREQUISITES	CO-REQUISITES
YEAR 2 SEMESTER 1					
MAT3611	Calculus I	6	16	MAT3512	None
MAT3661	Sets and Logic	6	8	MAT3511	None
MAT3641	Numerical Methods with MATLAB	6	8	MAT3521	None
STS3611	Probability Theory	6	16	STS3532 and MAT3512	None
STS3671	Statistical Methods	6	16	STS3532	None
YEAR 2 SEMESTER 2					
MAT3612	Calculus II	6	16	MAT3512	None
MAT3652	Elementary Linear Algebra	6	16	MAT3511or MAT3512 and MAT3521	None
MAT3642	Ordinary Differential Equations	6	8	MAT3521 and MAT3512	None
STS3652	Fundamentals of Statistical Computing	6	16	STS3531	None
STS3672	Distribution Theory	6	16	STS3532	STS3611 and MAT3611
Total Credit			136		

YEAR 3

COURSE CODE	COURSE / NAME	NQF Level	CREDITS	PREREQUISITES	CO-REQUISITES
YEAR 3 SEMESTER 1					
MAT3731	Real Analysis I	7	16	MAT3611 & MAT3612	None
MAT3711	Linear Algebra I	7	16	(MAT3611 or MAT3612) and MAT3661 & MAT3652	None
MAT3701	Numerical Analysis I	7	8	(MAT3611 or MAT3612) and MAT3641	None
MAT3781	Elements of Set Theory	7	8	(MAT 3611 or MAT3612) and MAT3661	None
MAT3761	Research Methodology	7	8	MAT3661	None
STS3771	Statistical Inference	7	16	STS3671	None
YEAR 3 SEMESTER 2					
MAT3732	Real Analysis II	7	16	MAT3611 and MAT3612	None
MAT3712	Linear Algebra II	7	16	(MAT 3611 or MAT3612) and MAT3661 & MAT3652	None
MAT3742	Vector Analysis	7	8	MAT3611 and MAT3612	None
MAT3722	Number Theory	7	8	(MAT3611 or MAT 3612) and MAT3661	None
MAT3752	Partial Differential Equations	7	16	(MAT3611 or MAT3612) and MAT3642	None
Total Credit			136		

YEAR 4

COURSE CODE	COURSE / NAME	NQF Level	CREDITS	PREREQUISITES	CO-REQUISITES
YEAR 4 SEMESTER 1					
MAT3810	Research Project	8	32	All mathematics courses up to Year 3	None
MAT3811	General Topology	8	16	MAT3731 or MAT3732	None
MAT3871	Numerical Analysis II	8	16	MAT3701 or MAT3732	None
MAT3851	Complex Analysis I	8	16	MAT3731 or MAT3732	None
YEAR 4 SEMESTER 2					
MAT3822	Normed Vector Spaces	8	8	(MAT3731 or MAT3732) & (MAT3711 or MAT3712)	None
MAT3802	Category Theory	8	8	MAT 3781	None
MAT3872	Algebra	8	16	MAT 3711 or MAT 3712	None
MAT3852	Complex Analysis II	8	16	MAT 3731 or MAT 3732	None
Total Credit			128		

F.9. BACHELOR OF SCIENCE IN FINANCIAL MATHEMATICS HONOURS 11BFMA

Students enrolled in the **B.Sc. in FINANCIAL MATHEMATICS** Honours programme must take all of the following courses:

YEAR 1

COURSE CODE	COURSE	NQF Level	CREDITS	PRE- REQUISITES	CO-REQUISITES
YEAR 1 SEMESTER 1					
LCE3419	English Communication & Study Skills	4	16		
MAT3511	Basic Mathematics	5	16		
CLC3509	Computer Literacy	5	8		
MAT3501	Analytic Geometry	5	8		
MAT3521	Matrices and Complex Numbers	5	8		
EMI3571	Basic Microeconomics	5	16		
YEAR 1 SEMESTER 1					
LEA3519	English for Academic Purposes	5	16		
CSI3580	Contemporary Social Issues	5	8		
MAT3512	Precalculus	5	16		
MAF3532	Basic Financial Mathematics	5	16		
MAF3552	Mathematical Statistics	5	16		
EMA3572	Basic Macroenomomics	5	16		
Total Credits			160		

YEAR 2

COURSE CODE	COURSE	NQF Level	CREDITS	PRE-COREQUISITES	CO-REQUISITES
YEAR 2 SEMESTER 1					
MAT3611	Calculus I	6	16	MAT3512	None
STS3611	Probability theory	6	16	MAF3552	None
MAT3641	Numerical Methods with MATLAB	6	8	MAT3521	None
MAF3651	Financial Mathematics I	6	16	MAF3532	None
MAF3671	Economics I	6	16	EMA3572 & EMI3571	None
YEAR 2 SEMESTER 2					
MAT3612	Calculus II	6	16	MAT3512	None
MAF3652	Financial Mathematics II	6	16	MAF3532	None
MAF3672	Economics II	6	16	EMA3572 & EMI3571	None
STS3672	Distribution theory	6	16	MAF3552	STS3611 & MAT3611
Total Credits			144		

YEAR 3

COURSE CODE	COURSE	NQF Level	CREDITS	PRE-REQUISITES	CO-REQUISITES
YEAR 3 SEMESTER 1					
MAT3731	Real Analysis I	7	16	MAT3611 & MAT3612	None
MAF3751	Assets and Liabilities	7	16	MAF 3651 & MAF3652	None
MAT3701	Numerical Analysis I	7	8	(MAT3611 or MAT3612) & MAT3641	None
MAF3771	Differential Equations & Integral Transforms	7	16	MAT3611 or MAT3612	None
STS3771	Statistical Inference	7	16	MAF3552	None
YEAR 3 SEMESTER 2					
MAT3732	Real Analysis II	7	16	MAT3611 & MAT3612	None
MAF3762	Mathematical Modeling	7	8		MAF3771
MAF3782	Financial Modeling	7	8		MAF3771
MAF3732	Risk Theory	7	16	MAF3651 & MAF3652	None
MAF3742	Programming	7	8	MAT3641	None
MAF3722	Research Methodology	7	8	STS3611 and STS3632	None
Total Credits			136		

YEAR 4

COURSE CODE	COURSE	NQF Level	CREDITS	PRE-REQUISITES	CO-REQUISITES
YEAR 4 SEMESTER 1					
MAF3881	Elements of Dynamical Systems	8	8	MAF3751 & MAF3732	None
MAF3831	Risk Management	8	16	MAF3751 & MAF3732	None
STS3831	Stochastic Processes	8	16	STS3672 & MAF3732	None
MAF3821	Mathematical Methods	8	8	MAF3671 & MAF3672	None
MAF3810	Research Project	8	32	All courses up to third year	None
YEAR 4 SEMESTER 2					
MAF3812	Stochastic Calculus and Finance	8	16	MAF3751 & MAF3732	None

MAF3842	Operations Research	8	8	STS3672 & MAF3732	None
MAT3871	Numerical Analysis II	8	16	MAT3701 or MAT3732	None
MAF3862	International Business Finance	8	8	MAF3732 & MAF3751	None
Total Credits			128		

F.9.1 DEGREE ARTICULATION PROGRAMME

F.9.1.1 PURPOSE

The purpose of this qualification is to provide an opportunity for holders of a level 7 degree in Mathematics or a pre-NQF degree in Mathematics to upgrade to a level 8 honours degree. It further provides students with a good foundation in Mathematics, and will enable successful candidates entry into almost any type of post-graduate studies, or employment in the education, public, private and financial sectors where skills in mathematical problem analysis and solving, modeling and scientific research are required.

F.9.1.2 ADMISSION REQUIREMENTS

1) The applicant must be in possession of EITHER

- A BSc degree in Mathematics at NQF level 7.
  OR
- A pre-NQF BSc degree in Mathematics or equivalent qualification from a recognized institution.

2) Students who have completed a double major Bachelor's degree may be required to register for a number of undergraduate modules for non-degree purposes in order to gain admission into this programme.

F.9.1.3 DURATION OF STUDY

The minimum duration of the study is one year and the maximum duration is two years.

F.9.1.4 REQUIREMENTS FOR AWARD OF QUALIFICATION

This qualification will be awarded to candidates who have passed all prescribed modules in the curriculum framework with a minimum of 134 credits.

F.9.1.5 SUMMARY TABLE FOR ALL MODULES IN THE ARTICULATION PROGRAMME

YEAR 1

COURSE CODE	COURSE / NAME	NQF Level	CREDITS	PREREQUISITES	CO-REQUISITES
SEMESTER 1					
MAT3811	General Topology		16	None	None
MAT3871	Numerical Analysis II		16	None	None
MAT3851	Complex Analysis I		16	None	None
MAT3880	Research Methodology and Project		38	None	None
SEMESTER 2					
MAT3822	Normed Vector Spaces		8	None	None
MAT3802	Category Theory		8	None	None
MAT3872	Algebra		16	None	None
MAT3852	Complex Analysis II		16	None	None
Total Credit			134		

F.9.1.6. MATHEMATICS HONOURS AND FINANCIAL MATHEMATICS HONOURS CURRICULUM COURSE DESCRIPTIONS

FIRST YEAR COURSES

MAT3511 BASIC MATHEMATICS (MAT3580 BASIC MATHEMATICS A)

Course Code: MAT3511
NQF Level: 5
Notional Hours: 160
NQF Credits: 16
Prerequisite: None
Contact Hours: 4 lectures plus 2 tutorials per week for one semester
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper)
Course description: Algebraic expressions: Simplification, expansion, factorization, polynomials, remainder and factor theorem, quadratic polynomial. Binomial expansions, Pascal's triangle and the Binomial Theorem.Rational expressions, partial fractions. Equations and inequalities: Linear equations in one-variable, simultaneous linear equations, quadratic equations, simultaneous non-linear equations. Linear inequalities, non-linear inequalities. Sets: What is a set? Set notation, equality of sets, subsets, characterization of equality via the subset relation, empty set, power sets, Venn diagrams, intersection, union, complement, de Morgan's laws, set difference, symmetric difference, proofs of simple results on set equality. Standard examples of sets: natural numbers, integers, rationals, real numbers. Absolute value, intervals in R. A bit about cardinality of sets (examples of finite, infinite, countable, uncountable sets). Trigonometry: Trigonometric ratios, angle orientation in the xy-plane, graphs of trigonometric functions , trigonometric identities, justifying (proving) equality of relatively simple trigonometric expressions. Sum/difference, double angle, half angle and sum to product formulas. Sequences: Definition, notation, obtaining the general term in sequences, arithmetic sequences, geometric sequences, recursively defined sequences.

MAT3501 ANALYTIC GEOMETRY (MAT3520 ANALYTIC GEOMETRY A)

Course Code: MAT3501
NQF Level: 5
Notional Hours: 80
NQF Credits: 8
Prerequisite: None
Contact Hours: 2 lectures plus 1 tutorial per week for one semester
Course Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).
Course description: Introduction: Lines, circles and tangent lines. Conic sections: ellipse, parabola, hyperbola. Translation and rotation of the axes. Parametric equations: circle, ellipse, Parabola, Hyperbola, cycloids. Polar coordinates: definition, relating polar and Cartesian coordinates, Conic sections in polar coordinates. Surfaces and quadrics: Spheres, cylinders, ellipsoids, paraboloids, hyperboloids, cones. Spherical and cylindrical coordinates.

MAT3521 MATRICES AND COMPLEX NUMBERS (MAT3540 MATRICES AND COMPLEX NUMBERS A)

Course Code: MAT3521
NQF Level: 5
Notional Hours: 80
NQF Credits: 8
Prerequisite: None
Contact Hours: 2 lectures plus 1 tutorial per week for one semester
Course Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).
Course description: Vectors in 2-and 3-dimensions: addition of vectors, multiplication by a scalar, norm of a vector, dot product, cross product. Lines and planes in 3D-space.Systems of linear equations: introduction to linear systems, solution by Gaussian elimination and Gauss–Jordan elimination (for up to 3 x 3). Matrices: addition, multiplication, scalar multiplication, transpose (for up to 3 x 3), elementary matrices, diagonal, triangular and symmetric matrices, determinant and inverse (for up to 3 x 3), solutions of systems of linear equations by Cramer's rule (for up to 3 x 3). Complex Numbers: complex planes, operations on complex numbers, modulus, complex conjugate, division, modulus-argument form, de Moivre's formula, Euler's formula, Fundamental Theorem of Algebra.

MAT3512 PRECALCULUS (MAT3570 PRECALCULUS A)

Course Code: MAT3512
NQF Level: 5
Notional Hours: 160
NQF Credits: 16
Prerequisite: None
Contact Hours: 4 lectures plus 1 x 2 hour tutorial per week for one semester
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).
Course description: Functions: one-to-one, onto and bijective functions, horizontal line test, inverse of a function. **Combinations of functions:** composition of functions, sum, difference, quotient of functions and their domains. Polynomial functions, rational functions and their graphs. Introduction of exponential and logarithmic functions.Trigonometric functions and their graphs, inverse trigonometric functions, trigonometric equations. **Limit of a function:** definition, left and right limits, improper limits, continuity in terms of limits. **Differentiation:** rate of change, derivative of a function, rules of differentiation, derivatives of polynomial and rational functions, increasing and decreasing functions and graph sketching. **Integration:** Antiderivatives (polynomial functions and rational exponents), the definite integral, area under a graph.

MAF3552 MATHEMATICAL STATISTICS

Course Code: **MAF3552**
NQF level: 5
National hours: 160
NQF Credits: 16
Prerequisite: None
Contact hours: 4 lectures per week for one semester 2 tutorials per week for one semester
Course Assessment: Continuous assessment 50% (at least 3 tests), examination 50% (3 hours examination paper).

Course description: Collection and presentation of data, data types, types of measurements – nominal, ordinal, interval, ratio scales – tabular forms, frequency tables, histograms, pie charts, frequency polygons, ogives. Measures of central tendency – mean, median, mode, quartiles, percentiles. Measures of dispersion – range, variance, standard deviation, skewness, kurtosis, Counting techniques – permutation and combination, Probability –axioms, sample space, identification of events, mutually exclusive events, independent events. Conditional probability, Baye's theorem, Probability functions of random variables - Discrete probability distributions – Binomial, Poisson, hyper-geometric distribution, Continuous probability distributions – normal distribution.

MAF3532 BASIC FINANCIAL MATHEMATICS

Course name: **BASIC FINANCIAL MATHEMATICS**
Code: **MAF3532**
NQF level: 5
Contact hours: 4 lectures per week for one semester 2 tutorials per week for one semester
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: None

Course description: Time value of money – simple interest and compound interest calculations – present value and future value – Nominal and effective interest rates – force of interest – inflation and real rate of interest.

Valuation of annuities - level payment annuities, accumulated value of an annuity, present value of an annuity, Future of value of an annuity, annuity-immediate and annuity due, some generalizations of annuity, e.g differing interest and payment period, continuous annuity.

Measuring the rate of an investment: internal rate of return and net present value, dollar – weighted and time –weighted rate of return, applications and illustration eg the portfolio method and the investment year method

SECOND YEAR COURSES

MAT3661 SETS AND LOGIC

Course Code: **MAT3661**
NQF Level: 6
Notional Hours: 80
NQF Credits: 8
Prerequisite : MAT3511
Contact Hours: 2 lectures plus 1 tutorial per week for one semester
Course Assessment: Continuous Assessment: 50% (minimum of 2 class tests). Examination: 50% (1 x 2-hour paper).

Course description: **Basic logic:** propositions and predicates. Conjunction, disjunction, negation, implication, contrapositive, equivalence. **Elementary methods of proof:** direct, contrapositive, contradiction. **Sets:** symmetric difference of two sets, de Morgan's laws, power set, partition, Cartesian product, definition of a binary relation, functions as binary relations, order relations. **Real numbers:** natural numbers, integers, positional number systems. The Principle of Mathematical Induction.

MAT3611 CALCULUS I

Course Code: **MAT3611**
NQF Level: 6
Notional Hours: 160
NQF Credits: 16
Prerequisite: MAT3512
Contact Hours: 4 lectures plus 2 tutorials per week for one semester
Course Assessment: Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).

Course description: Limits and continuity of functions: limit at a point, improper limits, continuity. **Derivatives:** definition, rules of differentiation, chain rule, derivatives of higher order, implicit differentiation, logarithmic differentiation, derivative of the inverse function, derivatives of exponential and logarithmic functions. **Some applications of the exponential functions:** growth and decay. Derivatives of arc functions (inverse trigonometric functions), derivatives of hyperbolic functions, derivatives of area functions (inverse hyperbolic functions). **Applications of the derivative**: extrema of functions, concavity and curve sketching, applications to optimization problems, related rates. Rolle's Theorem, The Mean Value Theorem, L'Hospital's rule. **Integration:** antiderivatives, integration by substitution.

MAT3641 NUMERICAL METHODS WITH MATLAB

Course Code: **MAT3641**
NQF Level: 6
Notional Hours: 80
NQF Credits: 8
Prerequisite: MAT3521
Contact Hours: 2 lectures plus 1 tutorial per week for one semester
Course Assessment: Continuous Assessment: **50%** (minimum of 2 class tests). Examination: **50%** (1 x 2-hour paper).

Course description: The MATLAB Environment: arithmetic operations with MATLAB, matrix algebra with MATLAB, MATLAB scripts, matrix operators, graphic output, flow control, MATLAB functions, system of linear equations. **Numerical Methods:** system of non-linear equations, optimization, interpolation, regression, numerical differentiation, quadrature, differential equations. **Application:** dynamical systems, stochastic processes (e.g. throwing dice, tossing coins and dealing cards), discrete processes (e.g. population dynamics), continuous processes (e.g. chemical reactions and kinetics).

MAT3642 ORDINARY DIFFERENTIAL EQUATIONS

Course Code: **MAT3642**
NQF Level: 6
Notional Hours: 80
NQF Credits: 8
Prerequisite : MAT3521 and MAT3512
Contact Hours: 2 lectures plus 1 tutorial per week for one semester
Course Assessment: Continuous Assessment: **50%** (minimum of 2 class tests). Examination: **50%** (1 x 2-hour paper).

Course description: First order differential equations, linear differential equations of second order, series solutions of second order linear equations, The Laplace transform, systems of first order linear equations.

MAT3612 CALCULUS II

Course Code **MAT3612**
NQF Level 6
Notional Hours 160
NQF Credits 16
Prerequisite MAT3512
Contact Hours 4 lectures plus 2 tutorials per week for one semester
Course Assessment: Continuous Assessment: **50%** (minimum of 3 class tests). Examination: **50%** (1 x 3-hour paper)

Course description: Integration: Riemann sums and the definite integral, the Fundamental Theorem of Calculus, approximations of the Riemann integral using the trapezoidal rule and Simpson's rule, average value of a function on an interval. **Integration techniques:** integration by parts, reduction formulae, trigonometric substitutions, integration of rational functions. **Applications of the Riemann integral:** area of a region bounded by graphs, volume of a solid of revolution, arc length, surface of revolution. Partial differentiation, chain rule, directional derivatives. Classification of critical points for two-variable functions**. Sequences and series of real numbers:** the limit of a sequence, absolutely convergent series, tests of convergence. **Power series:** radius of convergence, interval of convergence, McLaurin and Taylor series, the Binomial Theorem. Double integration, iterated integrals, use of polar coordinates, application of double integration to finding area and volume. Improper integrals..

MAT3652 ELEMENTARY LINEAR ALGEBRA

Course Code **MAT3652**
NQF Level 6
Notional Hours 160
NQF Credits 16
Prerequisite Any full course of the first year and MAT3521
Contact Hours 4 lectures plus 2 tutorials per week for one semester
Course Assessment: Continuous Assessment: **50%** (minimum of 3 class tests). Examination: **50%** (1 x 3-hour paper).

Course description: Matrices: determinant; cofactor expansion, inverse, adjoint and Cramer's rule. Similar matrices. Eigenvalues and eigenvectors . Diagonalization. Symmetric and skew-symmetric matrices. Orthogonal matrices. Hermitian, skew-Hermitian and unitary matrices. Linear algebra in $\mathbf{R}^2$, $\mathbf{R}^3$ and $\mathbf{R}^n$: Vector spaces, subspaces, linear combination of vectors, linearly independent and linearly dependent vectors, span, basis, dimension, rank and nullity. Points, lines, planes and hyperplanes in $\mathbf{R}^2$, $\mathbf{R}^3$ and $\mathbf{R}^n$.orthogonality, angle.

MAF3651 FINANCIAL MATHEMATICS I

Course name: **FINANCIAL MATHEMATICS I**
Code: **MAF3651**
NQF level: 6
Contact hours: 4 lectures per week for one semester 2 tutorials per week for one semester
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: MAF3532

Course description: Loan repayment: the amortization method of loan repayment, amortization of loan with level payment, the sinking – fund method of loan repayment.

Bond Valuation: coupon bearing bond, the value of a bond, how bond prices changes, notation, bond performance, the zero curve, determination of bond price, amortization of a bond, application and illustrations, e.g callable bonds, serial bonds etc.

Options: call options, the put options, put-call parity, strategies involving multiple calls and puts.

Option pricing: risk neutral probabilities, multi-stage binomial trees, Black-Scholes formula, further options. Credit derivatives: default risk, credit risk ratings, credit spread, credit spread risk and default probabilities.

MAF3652 FINANCIAL MATHEMATICS II

Course name: **FINANCIAL MATHEMATICS II**
Code: **MAF3652**
NQF level: 6
Contact hours: 4 lectures per week for one semester 2 tutorials per week for one semester
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite : MAF3532

Course description: The term structure of interest rate: spot rate of interest, the relationship between spot rates of interest and yield to maturity on coupon bonds, forward rate of interest, applications and illustrations eg arbitrage, the force of interest as a forward rate, at-par Yield, interest rate swaps.

Forward Contracts: the forward contracts, calculating the delivery price, delivery price and forward price, the value of the forward contract, assets paying dividend, forward contracts on assets that pay discrete dividends, forward contracts on assets paying a continuous dividend value of a forward contract. Future market: futures contracts, closing out position, profit or loss when a position is closed out, use of the future contracts, hedging, hedging ratio, practical hedging: the optimal hedge ratio. The forward rate, forward rate agreements, swaps, caps, and floors. Stocks, short sales and options: stock valuation, short sale of stock, options, mutual funds, exchange traded funds, capital asset pricing model.

MAF3671 ECONOMICS I

Course name: **ECONOMICS I**
Code: **MAF3671**
NQF level: 6
Contact hours: 4 lectures per week for one semester 2 tutorials per week for one semester
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: EMA3572 and EMI3571

Course description: Consumer theory: The objectivity of the consumer, consumer tastes, preferences, and utility, concept of utility, cardinal and ordinal utility, indifference curves, budget constraint. Consumer behavior and individual demand, Utility maximization, Effects of changes in income and commodity prices, income and substitution effects, consumer surplus. Market demand, from individual to market demand, price and income elasticity of demand, Cross elasticity of demand, Applications. **Theory of the firm:** Goal of the firm, Production function, Short run, Law of diminishing marginal returns, Factor-product relationship, Long-run (Returns of scale), Factor-factor relationship, Isoquants, Isocosts, Least-cost combination, Elasticity of substitution, Costs and cost functions, types of costs, short run, Long –run. Market structure: perfect competition, price determination in short –run and long –run, welfare effects of perfect competition, Effects of government intervention; price ceiling.

Monopoly, price effects of perfect completion, Effects of government intervention, price ceiling. Monopoly, price determination in the short-run and long- run, Comparison with perfect competition, Monopoly power, price discrimination.

MAF3672 ECONOMICS II

Course name: **ECONOMICS II**
Code: **MAF3672**
NQF level: 6
Contact hours: 4 lectures per week for one semester 2 tutorials per week for one semester
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: EMA3572 and EMI3571

Course description: The scope and methodology of macroeconomics, Goals of macroeconomics policy, School of macroeconomics thought. National Income Accounting-Review, Key concepts in national income accounting, GDP at current prices and GDP at factor cost, GDP and GNP, Gross GDP and net GDP, Nominal GDP and real GDP, Consumer price indices and GDP deflators, GDP at constant prices, Methods of estimating GDP, Product approach, Income approach, Expenditure approach, Problems encountered in estimating GDP, Conceptual problems, Practical problems; Limitations of GDP as an indicator of welfare, The good market, Review of Determination of equilibrium income: The Keynesian Model, aggregate supply – demand approach, investment – saving approach, Keynesian expenditure multipliers, investment expenditure multiplier, government expenditure multiplier, autonomous tax multiplier, balanced budget multiplier, Application of Keynesian Model, Effects of Aggregate demand shocks, changes in investment spending, changes in government spending, other policy changes: taxes; transfers. Micro Foundations of Macroeconomics, Consumer function, Aggregate consumption function; Absolute income hypothesis, relative income hypothesis, permanent income hypothesis, life cycle hypothesis, Investment function, The decision to invest: present value concept, marginal efficiency of investment and the rate of interest; the accelerator theory of investment, the internal funds theory of investment; the neo-classical theory of investment; the q-theory of investment, product market equilibrium and IS curve.

THIRD YEAR COURSES:

MAT3731 REAL ANALYSIS I

Course Code:	**MAT3731**
NQF Level:	7
Notional Hours:	160
NQF Credits:	16
Prerequisite:	MAT3611 and MAT3612
Contact Hours:	4 lectures plus 2 tutorials per week for one semester
Course Assessment:	Continuous Assessment: **50%** (minimum of 3 class tests). Examination: **50%** (1 x 3-hour paper).

Course description: Real number system: algebraic and order properties, bounded sets, infimum, supremum, Completeness Axiom. **Metric spaces:** Definition and examples, open balls and open sets. Sequences and series of real numbers, limit theorems, monotone sequences, Cauchy criterion, limsup, liminf, cluster points, Cauchy sequences, dense sets.
Continuous functions: equivalent definitions of continuity, uniform continuity, limit of a function, discontinuities of real-valued function, compact spaces and their properties, continuous functions on compact spaces, characterization of compactness. **Complete metric spaces:** examples, Baire Category Theorem, Banach Contraction Principle.

MAT3701 NUMERICAL ANALYSIS I

Course Code:	**MAT3701**
NQF Level:	7
Notional Hours:	80
NQF Credits:	8
Prerequisite:	(MAT3611 or MAT 3612) and MAT3641
Contact Hours:	2 lectures plus 1 tutorial per week for one semester
Course Assessment:	Continuous Assessment: **50%** (minimum of 2 class tests). Examination **50%** (1 x 2-hour paper).

Course description: Errors and types of errors: round off error, truncation error, propagation of error.
Root finding methods for non-linear equations: the bisection method, secant method, Regula falsi method, Newton-Raphson method. **Zeros of algebraic equations:** Muller's method and Newton-Horner method. **Systems of linear equations:** matrix methods, Gauss elimination method, LU factorization, pivoting, computing the inverse of a matrix. **Iterative methods:** convergence of iterative methods, Jacobi, Gauss-Seidel and relaxation methods. **Interpolation:** Lagrange polynomials, divided differences, Newton-Gregory forward and backward polynomials, error terms and error of interpolation, interpolating with splines.

MAT3781 ELEMENTS OF SET THEORY

Course Code:	**MAT3781**
NQF Level:	7
Notional Hours:	80
NQF Credits:	8
Prerequisite:	(MAT3611 or MAT 3612) and MAT3661
Contact Hours:	2 lectures plus 1 tutorial per week for one semester
Course Assessment:	Continuous Assessment: **50%** (minimum of 2 class tests). Examination **50%** (1 x 2-hour paper).

Course description: Ordered pairs and the product of two sets. Functions: definition of a function as a set of ordered pairs, images and pre-images, injective, surjective and bijective functions, restriction of a function, Cantor's Theorem. **Equipotent sets:** countable sets, product of two countable sets, countability of Q, uncountability of R. Families of sets, the Axiom of Choice and its applications. **Binary relations:** equivalence relations, equivalence classes, transversals, order relations, upper and lower bounds, greatest and least elements, maximal and minimal elements, Zorn's Lemma and its applications.

MAT3711 LINEAR ALGEBRA I

Course Code:	**MAT3711**
NQF Level:	7
Notional Hours:	160
NQF Credits:	16
Prerequisite:	(MAT3611 or MAT3612) and MAT3661 and MAT3652
Contact Hours:	4 lectures plus 2 tutorials per week for one semester
Course Assessment:	Continuous Assessment: **50%** (minimum of 3 class tests). Examination: **50%** (1 x 3-hour paper).

Course description: Vector spaces: definition and examples. Subspaces, examples of subspaces, operations on subspaces, sum of subspaces, complement of a subspace, Dedekind's law, linear combination of vectors. Linearly independent and dependent set of vectors, span of a set of vectors, definition of a basis, existence of a basis and dimension of a finitely generated vector space, dimension formula for subspaces. **Linear mappings:** examples, image and preimage of a subspace, kernel, image, rank and defect, isomorphism, automorphism, coset, factor space, dimension of a factor space, coordinates, homomorphism theorem, dimension formula for linear mappings, linear form, hyperplane, dual spaces, dual basis, annihilators.

MAT3722 NUMBER THEORY

Course Code	**MAT3722**
NQF Level	7
Notional Hours	80
NQF Credits	8
Prerequisite	(MAT3611 or MAT3612) and MAT3661
Contact Hours	2 lectures plus 1 tutorial per week for one semester
Course Assessment:	Continuous Assessment: **50%** (minimum of 2 class tests). Examination: **50%** (1 x 2-hour paper).

Course description: Divisibility of integers, congruences, Euclidean Division, greatest common divisor and least common multiple of a set of integers, Euclid's algorithm, prime numbers, Fermat primes and Mersenne primes, the prime number theorem, existence of a prime divisor of an integer, p-exponents, the Fundamental Theorem of Arithmetic, the sigma-function, Euler's formula for the sigma-function, perfect numbers, even perfect numbers, Euler's phi-function, examples of Diophantine equations.

MAT3752 PARTIAL DIFFERENTIAL EQUATIONS

Course Code:	**MAT3752**
NQF Level:	7
Notional Hours:	160
NQF Credits:	16
Prerequisite:	(MAT3611 or MAT3612) and MAT3642
Contact Hours:	4 lectures plus 2 tutorials per week for one semester
Course Assessment:	Continuous Assessment: 50% (minimum of 3 class tests). Examination: 50% (1 x 3-hour paper).

Course description: Definition of a partial differential equation, formation of partial differential equations, linear first order equations, Lagrange's linear equation of first order. Solving non-linear first order equations of the types f(p,q) = 0, f(p,q,z)= 0, f(x,p) = g(y,q), z =px+qy+f(p,q), Charpit's method. **Homogeneous linear equations with constant coefficients:** complementary function and particular integral, general solution.Non-homogeneous linear equations: non-linear equations of the second order, Monge's method. **Fourier series:** definition, periodic functions, Dirichlet's conditions, full-range and half-range series, determination of Fourier coefficients, Fourier series of even and odd functions, Fourier series in arbitrary intervals. **Classification of linear second order equations:** parabolic, hyperbolic, elliptic, method of separation of variables**. Applications of partial differential equations:** one-dimensional wave equation with boundary conditions in a vibrating string, one-dimensional heat-flow equation, steady state and transient solutions, non-homogeneous boundary conditions.

MAT3732 REAL ANALYSIS II

Course Code:	**MAT3732**
NQF Level:	7
Notional Hours:	160
NQF Credits:	16
Prerequisite:	MAT3611 and MAT3612
Contact Hours:	4 lectures plus 2 tutorials per week for one semester
Course Assessment:	Continuous Assessment: **50%** (minimum of 3 class tests). Examination: **50%** (1 x 3-hour paper).

Course description: Differentiation of single variable functions: derivatives, the chain rule, local extrema, Rolle's Theorem, Mean Value Theorem, Taylor's Theorem. **Riemann integral:** Definition, linear properties of the integral, necessary and sufficient conditions for the existence, First Fundamental Theorem of Integral Calculus, Mean Value Theorems for integrals, Second Fundamental Theorem of Integral Calculus, change of variable in a Riemann integral, Second Mean Value Inequality for Riemann integrals. **Sequence and series of functions:** Point-wise convergence, uniform convergence, uniform convergence and integration, uniform convergence and differentiation, sufficient conditions for uniform convergence of a series. **Functions of Severable variables:** directional derivative, total derivative, Jacobian, chain rule, Mean Value Theorem, Taylor's formula.

MAT3742 VECTOR ANALYSIS

Course Code	**MAT3742**
NQF Level	6
Notional Hours	80
NQF Credits	8
Prerequisite	MAT3611 and MAT3612
Contact Hours	2 lectures plus 1 tutorial per week for one semester
Course Assessment:	Continuous Assessment: **50%** (minimum of 2 class tests). Examination: **50%** (1 x 2-hour paper).

Course description: Vector fields: Vector-valued functions and scalar fields, gradient, conservative vector fields, divergence and curl, solenoidal and irrotational fields, Laplace operator, differential vector identities. **Line integrals:** Definition, line integrals of vector fields, Fundamental theorem for line integrals, path independence, conservation of energy, Green's Theorem. **Surface and volume integrals:** Parametric surfaces, surface area, oriented surfaces, surface integrals of vector fields, Stokes' Theorem, volume.integrals and the Divergence Theorem.

MAT3712 LINEAR ALGEBRA II

Course Code	**MAT3712**
NQF Level	7
Notional Hours	160
NQF Credits	16
Prerequisite	(MAT3611 or MAT3612) and MAT3661 and MAT3652
Contact Hours	4 lectures plus 2 tutorials per week for one semester
Course Assessment:	Continuous Assessment: **50%** (minimum of 3 class tests). Examination: **50%** (1 x 3-hour paper).

Course Content: Endomorphisms: homothety, involution, projection, binomial formula, idempo-tent endomorphism, nilpotent endomorphism, centralizer of a set of endomorphisms, Schur's Lemma. Eigenvalue, eigenvector, eigenspace, the independence of the eigenspaces of an endomorphism. **Matrix theory:** representation of a linear mapping by a matrix, change of basis, similar matrices. **Euclidean vector spaces of arbitrary dimension:** scalar product, existence of a scalar product, norm of a vector, Cauchy-Schwarz inequality, orthogonal basis, orthonormal basis, theorem of Riesz, orthogonal mappings. Determinantal forms, determinant of an endomorphism, cross product of a three-dimensional Euclidean vector space, characteristic polynomial.

MAF3771 DIFFERENTIAL EQUATIONS AND INTEGRAL TRANSFORMS

Course name:	**DIFFERENTIAL EQUATIONS AND INTEGRAL TRANSFORMS**
Code:	**MAF3771**
NQF level:	7
Notional Hours	60
NQF Credits	16
Prerequisite	MAT3611 or MAT3612
Contact hours:	4 lectures per week for one semester 2 tutorial per week for one semester
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).

Course description: First order equations: initial vale problems, separable, exact, homogeneous linear equations, integrating factor. **Second order equations:** linear homogeneous with constant coefficients, distinct, complex and repeated roots of the characteristic equation, nonhomogeneous equations, method of underdetermined coefficients and variation of parameters. Series solution of second order linear equations. Bessel's equation. **The Laplace transform:** solution of initial value problems, inverse Laplace transform. System of first order linear equations, homogenous linear system with constant coefficients. **First order equations:** basic properties of the linear equations, solutions of linear equations, the general first order nonlinear equation, applications. **Fourier series:** definition, periodic functions, Dirichlet's conditions, full-range and half-range series, determination of Fourier coefficients, Fourier series of even and odd functions, Fourier series in arbitrary intervals. Linear second order equations in two independent variables, classification of linear second order equations into parabolic, hyperbolic and elliptic equations. Separation of variables. Example: the one – dimensional wave equation, the vibrating string, boundary conditions associated with the wave equation.

MAF3751 ASSETS AND LIABILITIES

Course name:	**ASSETS AND LIABILITIES**
Code:	**MAF3751**
NQF level:	7
Contact hours:	4 lectures per week for one semester 2 tutorials per week for one semester
Credits:	16
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite:	MAF3651and MAF3652

Course description: Managing risk, Marketing, External environment, Investment environment, meeting investor needs, Capital, Interaction with client, Awareness of risk, Management of provision for liabilities, Project planning and management, Input validation. Methodology and techniques, Assumption setting, Design, Expenses, Developing the cost and the price, Provisioning, Relationship between assets and liabilities, Maintaining profitability, Determining the expected results, Reporting actual results, Risk Management, Asset management, Capital management, Surplus management, Mergers and acquisitions, Insolvency and closure, Options and guarantees, Monitoring , Principal terms.

MAF3762 MATHEMATICAL MODELING

Course name:	**MATHEMATICAL MODELING**
Code:	**MAF3762**
NQF level:	6
Contact hours:	2 lectures per week for one semester 1 tutorial per week for one semester
Credits:	8
Assessment:	Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Co-requisite:	MAF3771

Course description: MATLAB: Data types and control structures. Functions, procedures and subroutines and courses. Inputs and output. **Modeling Change:** Modeling Change with Difference Equations, Approximating Change with Difference Equations, Solutions to Dynamical Systems, and Systems of Difference Equations. The modeling Process, Proportionality, and Geometric Similarity: Mathematical Models, Modeling using Proportionality, Modeling using Geometric Similarity. **Model Fitting**: Fitting Models to Data Graphically, Analytic Method of Model Fitting,Applying the Least-Squares Criterion,Choosing a Best Model.Experimental Modeling: Harvesting and other One-Term Models,High-Order Polynomial Models, Smoothing: Low-Order Polynomial Models,Cubic Spline Models.

MAF3782 FINANCIAL MODELING

Course name:	**FINANCIAL MODELING**
Code:	**MAF3782**
NQF level:	7
Contact hours:	2 lectures per week for one semester 1 tutorial per week for one semester
Credits:	8
Assessment:	Continuous assessment **50%** (at least 2 tests), Practical examination **50%** (2 hours examination paper).
Co-requisite:	MAF3771

Course description: The course will examine the tools built in to Excel and VBA and their use in financial modeling. The tools will be introduces using concepts such as the time value of money, bond pricing, risk and return, financial planning and option pricing. Tools will include absolute cell references, names, lookup tables, formatting, spinners and (other controls), if statements, graphs, etc., as well as an introduction to VBA programming. A basic knowledge of Excel is assumed with no prior experience with VBA.

MAF3732 RISK THEORY

Course name:	**RISK THEORY**
Code:	**MAF3732**
NQF level:	7
Contact hours:	4 lectures per week for one semester 2 tutorials per week for one semester
Credits:	16
Assessment:	Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite:	MAF3651 and MAF3652

Course description: Loss distribution (Lognormal, Weibul, Gamma, Pareto, Negative Exponential and the like) and MLE's (Maximum Likehood estimates – both one or two parameters); Risk Models: A random sum of a random variable; Experience rating: NCD's (No Claim Discount Systems); Claims Reserving: Chain Ladder Method, Average Cost per Claim Method and BF (Bornhuetter Ferguson) Method – with and without claims inflation; Bayesian Statistics: Bayes theorem,

Loss estimators(quadratic, absolute error, all – or – nothing), and prior, likehood and posterior distribution; Ruin Theory: Poisson process, Lundberg inequality, adjustment coefficient, Reinsurance (Proportional and non-proportional)**;** Credibility Theory: Basic concept and models (Gamma/Poisson, Normal-Normal), Two Empirical Models(both theory and numerical); Decision Theory: very basic introduction, Introduction to statistical games, a decision function, a loss function and decision criteria(Minimax, Byes criteria); Generalized Linear Models.

MAF3742 PROGRAMMING

Course name:	**PROGRAMMING**
Code:	**MAF3742**
NQF level:	7
Contact hours:	2 lectures per week for one semester, 1 PRACTICAL per week for one semester
Credits:	8
Assessment:	Continuous assessment **100%** which consists of practical tests and practical assignments.
Prerequisite:	MAT3641

Course description: Problem solving strategies: the role of algorithms in the problem solving process, implementation strategies for algorithms, Debugging strategies, the concept and properties of algorithms. Program development steps: planning phase, analysis, design, implementation, testing, and maintenance.Introduction to C – Constants, Variables, Data types – Operator and Expressions. Managing Input and Output operations – Decision Making and Branching – Decision making and Looping. Arrays – Character Arrays and Strings – User defined Functions. Structures and unions – Pointers – File management in C. Dynamic memory allocation – Linked lists- Preprocessors – Programming Guide lines.

MAF3722 RESEARCH METHODOLOGY

Course name:	**RESEARCH METHODOLOGY**
Code:	**MAF3722**
NQF level:	7
Contact hours:	2 lectures per week for one semester 1 PRACTICALS per week for one semester
Credits:	8
Assessment:	Continuous Assessment: **100%** (Seminar presentation, proposal writing).
Prerequisite:	STS3611 and STS3672

Course description: This course provides students with the methodological foundations of quantitative business research. It introduces a number of financial databases and research methods commonly used in finance and investment and will prepare students to undertake research projects in the area of finance. Topics have included: time value of money, interest rates, the future value of a single cash flow, the frequency of compounding, continuous compounding, stated and effective rates. The future value of a series of cash flows, finding present value of a single cash flow, the frequency of compounding. Present value of a series of cash flows, solving for rates, number of periods, size of annuity payments, cash flow additively principle. Simulation of Bond prices, optimization with conditional, value-at-risk, investment analysis on oil industry, simulation of interest rate models, stochastic numerical CHEmes, game theory and its economic/financial applications, evolutionary game theory.

FOURTH YEAR COURSES:

MAT3811 GENERAL TOPOLOGY

Course Code: **MAT3811**
NQF Level: 8
Notional Hours: 160
NQF Credits: 16
Prerequisite: MAT3731 or MAT3732
Contact Hours: 4 lectures plus 2 tutorials per week for one semester
Course Assessment: Continuous Assessment: **50%** (minimum of 3 class tests). Examination: **50%** (1 x 3-hour paper).
Course description: Topological spaces: topology on a set, topological space, open set, closed set, boundary, base of a topological space, neighbourhood, filter and neighbourhood filter, base of a filter, ultrafilter, accumulation point, derived set, nowhere dense set, meagre set, set of second category, cluster points and limits of a sequence and of a filter, T_0-, T_1- and T_2-spaces, countability axioms, separable topological space, subspace, continuous function, connected subset, connected subsets of the real line, connected component, totally disconnected topological space, locally connected topological space, quasicompact space, compact space, locally quasicompact space, countably quasicompact space, theorem of Heine-Borel. **Metric spaces:** metric on a set, metric space, topology of a metric space, metrizable topological space, distance between a point and a subset, Cauchy sequence, Cauchy filter, completeness.

MAT3872 ALGEBRA

Course Code: **MAT3872**
NQF Level: 8
Notional Hours: 160
NQF Credits: 16
Prerequisite: MAT3711 or MAT3712
Contact Hours: 4 lectures plus 2 tutorials per week for one semester
Course Assessment: Continuous Assessment: **50%** (minimum of 3 class tests). Examination: **50%** (1 x 3-hour paper).
Course Content: Binary operations: properties of binary operations, powers of an element, semi-group, monoid. **Groups:** definition and examples, subgroup, subgroup generated by a subset, cyclic group, subgroups of a cyclic group, finitely generated group, cosets of a subgroup, homomorphism, normal subgroup, factor group, isomorphism, automorphism, homomorphism theorem, conjugacy class of an element, conjugacy class of a subgroup, characteristic subgroup. p-element, p-group. **Permutation groups:** orbits of a permutation group, stabilizer, length of an orbit, Gleason's Lemma. Cauchy's theorem, Sylow's theorem, applications. **Rings:** definition and examples, endomorphism ring of an abelian group, units group, characteristic, zero divisor, entire ring, division ring, field, subring, homomorphism, ideal, factor ring, homomorphism theorem, principal ideal domain, polynomial ring in a single indeterminate.

MAT3851 COMPLEX ANALYSIS I

Course Code: **MAT3851**
NQF Level: 8
Notional Hours: 160
NQF Credits: 16
Prerequisite: MAT3731 or MAT3732
Contact Hours: 4 lectures plus 2 tutorials per week for one semester
Course Assessment: Continuous Assessment: **50%** (minimum of 3 class tests). Examination: **50%** (1 x 3-hour paper).
Course description: The field C of the complex numbers: construction of C, absolute value, modulus argument form, roots of unity, non-orderability of C, C as a metric space, convex subsets of C, complex number plane, Riemann sphere. **Sequences and series:** bounded sequences, convergent sequences, subsequences, theorem of Bolzano-Weierstrass, completeness of C, Cesaro average of a sequence, Cauchy's theorem on the Cesaro average of a convergent sequence, convergent series, absolutely convergent series, re-arrangement of series, product of two series, Cauchy product, Cesaro's theorem on the Cauchy product of two convergent series, Abel's theorem on the Cauchy product.

MAT3822 NORMED VECTOR SPACES

Course Code: **MAT3822**
NQF Level: 8
Notional Hours: 80
NQF Credits: 8
Prerequisite: (MAT3731 or MAT3732) and (MAT3711 or MAT3712)
Contact Hours: 2 lectures plus 1 tutorial per week for one semester
Course Assessment: Continuous Assessment: **50%** (minimum of 2 class tests). Examination: **50%** (1 x 2-hour paper).
Course description: Definition of a normed vector space and examples, existence of a norm on a real or complex vector space, closed subspaces, examples of subspaces which are not closed, closedness of subspaces of finite dimension, equivalent norms, equivalence of norms of a vector space of finite dimension, continuity of linear mappings, norm of a continuous linear mapping, Banach spaces, Hilbert spaces, the dual of a normed vector space, continuity of a linear form in terms of the kernel, theorem of Hahn-Banach and the geometric interpretation of this theorem.

MAT3871 NUMERICAL ANALYSIS II

Course Code	**MAT3871**
NQF Level	8
Notional Hours	160
NQF Credits	16
Prerequisite	MAT3701 or MAT3732
Contact Hours	4 lectures plus 2 tutorials per week for one semester
Course Assessment:	Continuous Assessment: **50%** (minimum of 3 class tests). Examination: **50%** (1 x 3-hour paper).

Course description: Approximation: Least – square approximations, fitting non-linear curves by least squares, Legendre and Chebyshev polynomials, approximation of functions with economized power series, approximations with rational functions , norms and analysis of error optimization: First and second order Taylor approximations, the steepest descent method, zeroing the gradient and conjugate gradient method Numerical integration: Newton-Cotes integration formulas, trapezoidal rule, Romberg integration, Simpson's rules, Gaussian quadrature, adaptive integration, convergence criteria Numerical solution to Ordinary differential equations: Taylor series method, Euler and modified Euler methods, Runge-Kutta methods, Milne's method, the shooting method for boundary values problems, finite difference methods.

MAT3852 COMPLEX ANALYSIS II

Course Code	**MAT3852**
NQF Level	8
Notional Hours	160
NQF Credits	16
Prerequisite	MAT3731 or MAT3732
Contact Hours	4 lectures plus 2 tutorials per week for one semester
Course Assessment:	Continuous Assessment: **50%** (minimum of 3 class tests). Examination: **50%** (1 x 3-hour paper).

Course description: Differentiation: definition, rules of differentiation, Cauchy-Riemann equations.
Holomorphic functions: definition, mean value inequality. **Power series:** set of convergence, radius of convergence, Abel's Lemma, differentiability of the sum of a power series, exponential function, circular functions, Euler's formula. Integral of a continuous complex-valued function, rules of integration, standard estimate, fundamental theorem, path, operations on paths, rectifiable path, piecewise C1-path, path integral, Goursat's Lemma, star-shaped region, Cauchy's integral theorem, Cauchy's integral formula, Taylor series, analyticity of holomorphic functions, entire function, Liouville's theorem, fundamental theorem of algebra, isolated singularities, Laurent series, residue, methods to find the residue, residue theorem, applications.

MAT3802 CATEGORY THEORY

Course Code	**MAT3802**
NQF Level	8
Notional Hours	80
NQF Credits	8
Prerequisite	MAT3781
Contact Hours	2 lectures plus 1 tutorial per week for one semester
Course Assessment:	Continuous Assessment: **50%** (minimum of 2 class tests). Examination: **50%** (1 x 2-hour paper).

Course description: Categories: Definition; examples; duality principle; morphism types (mono-, epi-, bi-, isomorphism, sections and retractions); subobjects and quotients; object types (projective, injective, terminal, initial), subcategories; definitions of small, discrete, and concrete categories. **Functors:** Definition; full, faithful, and representative functors, equivalent and isomorphic categories, CAT (the category of small categories), forgetful functors. **Natural transformations:** Definition, examples, Godement products, Yoneda Lemma.

MAT3810 RESEARCH PROJECT

Course Code	MAT3810
NQF Level	8
Notional Hours	320
NQF Credits	32
Prerequisite	All courses of mathematics up to third year
Contact Hours	1 contact hour with supervisor per week throughout academic year
Course Assessment:	Continuous Assessment **100%** (Seminar Presentations: 30%, Written Project: 70%)

Course description: The student will be required to study and write up a research proposal and a coherent report on a given specific problem in mathematics. The student shall be required to give at least (2) two seminar presentations, one for his or her research proposal and the other for the research project on certain dates as determined by the Department of Mathematics. Although, depending on the magnitude of the problem, the student might not be able to solve the problem, he or she will be expected to find out how much is known about that problem. In the process the student will learn some mathematics required to understand and to solve the problem.

MAF3881 ELEMENTS OF DYNAMICAL SYSTEMS

Course name: **ELEMENTS OF DYNAMICAL SYSTEMS**
Code: **MAF3881**
NQF level: 8
Contact hours: 2 lectures per week for one semester 1 tutorials per week for one semester
Credits: 8
Assessment: Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite: MAF3751 and MAF3732
Course description: Definition of dynamical systems - one dimensional linear system - discrete time and continuous time linear system - applications in banking and finance = two or more dimensional linear systems - diagonalizable and nondiagonalizable - nonlinear systems - fixed points - stability - linearization in one dimension and multidimension - Lyapunov functions - Lyapunov's method - gradient systems - one dimensional non-linear systems with no periodicity - Poincare Bendixon method - Hopf bifurcation - Lorenz system and chaos - Discrete time -stability of periodic points bifurcation - Sarkovski's theorem.

MAF3831 RISK THEORY

Course name: **RISK MANAGEMENT**
Code: **MAF3831**
NQF level: 8
Contact hours: 4 lectures per week for one semester 2 tutorials per week for one semester
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: MAF3751 and MAF3732
Course description: **Market risk:** foreign exchange futures, swaps and options. Pricing relationships and contract structures. Measuring risk exposures and using derivatives to manage risks. Interest rate futures, FRAs, swaps and options. Alternative methods for estimating yield curves. Use of the yield curve for pricing cash flows.Using derivatives to manage risk.Financial engineering using derivatives.Liquidity risk.Value at Risk.Estimating Var including extreme value theory and alternative simulation methods**. Credit Risk:** credit rating, events of default, default probabilities. Structural and Reduced form models of credit risk. **Structural models:** Merton and KMV models. Bond Models: credit spreads. Transition probabilities. Correlations and default dependencies. Estimating losses given default. Copula approaches to estimating defaults. Portfolio models of credit risk. Creditmetrics, CreditRisk+, KMV. Stress testing. Managing credit risk using credit derivatives.Limitations and risk of credit derivatives.Combining market and credit risks.

MAF3821 MATHEMATICAL METHODS

Course name: **MATHEMATICAL METHODS**
Code: **MAF3821**
NQF level: 8
Contact hours: 2 lectures per week for one semester 1 tutorial per week for one semester
Credits: 8
Assessment: Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite: MAF3671 or MAF3672
Course description: Linear regression (univariate, bivariate, mulitivariate), Gauss-Markov theorem, Autocorrelations and heteroskedasticity, Instrumental variables and simultaneous equation models, Time series models, Maximum likelihood moments, Generalized method of moments, Models of conditional heteroskedasticity, Transaction level data analysis, Cointegration and error correction models.

MAF3812 STOCHASTIC CALCULUS AND FINANCE

Course name: **STOCHASTIC CALCULUS AND FINANCE**
Code: **MAF3812**
NQF level: 8
Contact hours: 4 lectures per week for one semester 2 tutorials per week for one semester
Credits: 16
Assessment: Continuous assessment **50%** (at least 3 tests), examination **50%** (3 hours examination paper).
Prerequisite: MAF3751 and MAF3732
Course description: General Probability theory, random variables and distributions, general conditional expectations, Jensen's inequality. Scaled random walks – symmetric random walk – Martingale property for the symmetric random walk – Log-normal distribution as the limit of the Binomial model. Brownian motion – distribution of Brownian motion – filtration of Brownian motion – Martingale property of Brownian motion, Quadratic variation and Volatility of Geometric Brownian motion – Markov property. Ito's integral for simple and general integrands – Ito Deblin formula – Black-Scholes Merton Equation – Ito-deblin formula for multiple processes. Risk Neutral pricing – Girsanov's theorem for single Brownian motion and Risk neutral measure – Martingale representation theorem, Fundamental theorems of Asset pricing.
Exotic options – Knockout barrier options – Lookback options – Asian options – Black Scholes Merton Equation
American derivative securities – Change of Numeraire.

MAF3862: INTERNATIONAL BUSINESS FINANCE

Course name:	**INTERNATIONAL BUSINESS FINANCE**
Code:	**MAF3862**
NQF level:	8
Contact hours:	2 lectures per week for one semester 1 tutorial per week for one semester
Credits:	8
Assessment:	Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite:	MAF3732 and MAF3751

Course description: Market and Linkage in international Financial Management, Multinational enterprise and international financial management, international flow of funds, international monetary systems, birth of global currency, emerging market crisis, international financial market, multinational financial management, exchange rate systems and policies, determination of exchange rate, equilibrium approach to exchange rate, exchange rate systems, currency risk, currency forecasting, measuring exposure to exchange rate fluctuation, forward exchange market and money market hedging, forward market, international money market, transaction hedging, derivatives, corporate uses and abuses of currency derivatives, swaps and interest rate derivatives, basic currency swaps, foreign exchange risk, international caital budgeting, Eurobond and hybrid instruments.

MAF3810 RESEARCH PROJECT

Course Code:	**MAF3810**
NQF Level:	8
Notional Hours:	320
NQF Credits:	32
Prerequisite:	All courses of financial mathematics up to third year
Contact Hours:	1 contact hour with supervisor per week throughout academic year
Course Assessment:	Continuous Assessment **100%** (Seminar Presentation: 30%, Written Project: 70%)

Course description: The student will be required to study and write up a research proposal and a coherent report on a given specific problem in mathematics. The student shall be required to give at least (2) two seminar presentations, one for his or her research proposal and the other for the research project on certain dates as determined by the Department of Mathematics. Although, depending on the magnitude of the problem, the student might not be able to solve the problem, he or she will be expected to find out how much is known about that problem. In the process the student will learn some mathematics required to understand and to solve the problem.

MAF3842 OPERATIONS RESEARCH

Course name:	**OPERATIONS RESEARCH**
Code:	**MAF3842**
NQF level:	8
Contact hours:	2 lectures per week for one semester 1 tutorial per week for one semester
Credits:	8
Assessment:	Continuous assessment **50%** (at least 2 tests), examination **50%** (2 hours examination paper).
Prerequisite:	STS3672 and MAF3732

Course description: Decision Analysis**:** Types of decision problems.Decision-making under uncertainty: basic concepts**.** Ways of expressing outcomes: Payoffs and opportunity losses; Characterizing the uncertainty in decision problems; Solving decision problems using the expected payoff criterion and the expected utility criterion; Classifying decision makers by their utility functions. Revising state of nature probabilities: Decision trees; Bayes' rule: solving decision problems using posterior probabilities. Deterministic EOQ Inventory models: Introduction type of inventory models, costs involved, assumptions, Basic Economic Order Quality model: assumptions, derivation, determination of EOQ when holding cost, the effect of a non-zero lead time, power-of-two ordering policies. Probabilistic inventory models: Basic concepts, single-period models, the concept of marginal analysis, Discrete versus continuous demands.Deterministic dynamic programming Network models: Basic concepts, minimal-spanning tree technique, maximal-flow technique, shortest-route technique.

MAT3810 RESEARCH METHODOLOGY AND PROJECT

Course Code	**MAT3810**
NQF Level	8
Notional Hours	380
NQF Credits	38
Prerequisite	None
Contact Hours	1 contact hour with supervisor per week throughout academic year
Course Assessment:	Continuous Assessment **100%** (Seminar Presentations: 30%, Written Project: 70%)

Course description: The delivery of this module begins with taught research methodology for a block period of 3 weeks in which a typical research article in Mathematics is analyzed in terms of its structure, style of writing, and presentation. The writing up of a research proposal on a given topic in Mathematics is taught. Matters of plagiarism, copyrights and intellectual property rights are highlighted. Further, the student will be inducted into in typesetting mathematical content using LaTeX, and preparing seminar presentations. For the rest of the year, the student will be required to carry out guided independent research, culminating in a written research proposal and a coherent written research report on a given specific problem in Mathematics. In the process, the student shall be required to give at least (2) two seminar presentations, one for his or her research proposal and the other for the research project on certain dates as determined by the Department of Mathematics. Although, depending on the magnitude of the problem, the student might not be able to solve the problem or come up with new results, he or she will be expected to find out how much is known about that problem. In the process the student will learn essential techniques required to understand and solve research problems in Mathematics.

F.9.1.7. MATHEMATICS: COURSE EQUIVALENTS

OLD COURSES (Started in 2008)	NEW COURSES (Revised in 2012)
MAT3511: Basic Mathematics MAT3580: Basic Mathematics A	MAT3511: Basic Mathematics MAT3580: Basic Mathematics A
MAT3531: Analytic Geometry, Complex Numbers and Matrices	MAT3501: Analytic Geometry MAT3521: Matrices and Complex Numbers
MAT3590: Analytic Geometry, Complex Numbers and Matrices A	MAT3520: Analytic Geometry A MAT3540: Matrices and Complex Numbers A
MAT3512: Precalculus MAT3570: Precalculus A	MAT3512: Precalculus MAT3570: Precalculus A
MAT3601: Sets and Numbers	MAT3661: Sets and Logic
MAT3611: Calculus I	MAT3611: Calculus I
MAT3621: Numerical Methods	MAT3641: Numerical Methods with MATLAB
MAT3612: Calculus II	MAT3612: Calculus II
MAT3642: Ordinary Differential Equations	MAT3642: Ordinary Differential Equations
MAT3652: Elementary Linear Algebra	MAT3652: Elementary Linear Algebra
MAT3701: Numerical Analysis I	MAT3701: Numerical Analysis I
MAT3711: Linear Algebra I	MAT3711: Linear Algebra I
MAT3721: Set Theory	MAT3781: Elements of Set Theory
MAT3731: Real Analysis I	MAT3731: Real Analysis I
MAT3741: Partial Differential Equations	MAT3752: Partial Differential Equations
NONE	MAT3761: Research Methodology
MAT3712: Linear Algebra II	MAT3712: Linear Algebra II
MAT3722: Number Theory	MAT3722: Number Theory
MAT3732: Real Analysis II	MAT3732: Real Analysis II
MAT3622: Vector Analysis	MAT3742: Vector Analysis
MAT3810: Research Project	MAT3810: Research Project
MAT3811: General Topology	MAT3811: General Topology
MAT3831: Algebra	MAT3872: Algebra
MAT3851: Complex Analysis I	MAT3851: Complex Analysis I
MAT3802: Category Theory	MAT3802: Category Theory
MAT3822: Normed Vector Spaces	MAT3822: Normed Vector Spaces
MAT3832: Numerical Analysis II	MAT3871: Numerical Analysis II
MAT3852: Complex Analysis II	MAT3852: Complex Analysis II

F.10 STATISTICS AND POPULATION STUDIES

F.10.1 DIPLOMA IN APPLIED STATISTICS

F.10.1.1. REGULATION PERTAINING TO DIPLOMA STUDIES

F.10.1.2. ADMISSION REQUIREMENTS

To qualify for admission to the Diploma in Applied Statistics, an applicant shall satisfy any one of the following minimum requirements:

a) A Namibian Senior Secondary Certificate (NSSC) or equivalent, obtained in not more than two examination sittings with a minimum of **22 points** in **5** subjects on the UNAM Evaluation Scale. **English** is a compulsory subject and should have been obtained on a First or second Language Ordinary Level with symbol **D** or higher. A symbol **D** or higher in **Mathematics** is also required.

b) Mature age entry (based on the results from the entry test)

F.10.1.3. DURATION OF STUDY

The Diploma in Applied Statistics cannot be completed in less than **two (2) years**. The Diploma must be completed within three **(3) years** of **full-time** study, unless special permission is granted for this period to be exceeded.

F.10.1.4. MODE OF DELIVERY

The Diploma in Applied Statistics is a **full-time** programme offered in the evening, so as to allow full-time working candidates to attend lectures. The programme comprises of a total credit of **256** and it is at Namibian Qualification Framework (NQF) level 5. The year 1 courses are at NQF level 4 whereas the year 2 courses are at NQF level 5.

F.10.1.5. EXAMINATION REGULATIONS

For detailed examination and promotion rules see the General Prospectus: Information, Regulations and Fees. A candidate will be eligible to write the examination if he/she has obtained the required continuous assessment mark of **40%**. Examination will be administered at the end of each semester.

F.10.1.6. MINIMUM REQUIREMENTS FOR RE-ADMISSION

To be readmitted to the Diploma programme, a student must have passed the minimum number of courses required as indicated below:

- **3 courses** (equivalent to **48 credits**) by the end of the first year; **2** of these courses (equivalent to **32** credits) must be **non-core**.
- **8** full courses (equivalent of **128 credits**) by the end of the second year

F.10.1.7. ADVANCEMENT AND PROGRESSION RULES

A student advances to the second academic year of study when at least **6** courses (equivalent to a minimum of **96** credits) of the curriculum for a first year have been passed.

F.10.1.8. MAXIMUM NUMBER OF COURSES PER YEAR

Students can register for all first year courses and thereafter, no more than **10** courses in any academic year.

F.10.1.9. ARTICULATION ROUTE

After successful completion of the Diploma, students may continue to the degree programs in Statistics or Population Studies.

QUALIFICATION: DIPLOMA IN APPLIED STATISTICS (11DSST)

YEAR 1

CODE	COURSE TITLE	NQF LEVEL	CREDIT	PRE-REQUISITE	CO-REQUISITES
CLC3509	Computer Literacy	5	8		None
STD2431	Basics of Statistics	4	16		None
STD2411	The Statistical System	4	16		None
CSI3580	Contemporary Social Issues	5	8		None
LEG2410	English for General Communication	4	32		None
STD2412	Index Numbers and Time series	4	16		None
MAT2432	Introduction to Mathematics	4	16		None
STD2452	Sampling concepts in Survey work	4	16		None
Total Credits			128		

YEAR 2

CODE	COURSE TITLE	NQF LEVEL	CREDIT	PRE-REQUISITE	CO-REQUISITES
STD2551	Basic Data Processing	5	16	STD2452	None
STS3532	Introduction to Probability	5	16	STD2431	None
STD2511	Statistical Methods and Techniques	5	16	STD2431	None
EMI3571	Basic Micro Economics	5	16		None
LEA3519	English for Academic Purposes	5	16		None
STD2552	Basic Statistical Modeling	5	16	STD2432	None
STD2512	Basic Demography and Epidemiology	5	16	STD2411	None
EMA3572	Basic Macro Economics	5	16		None
Total Credits			128		

F.10.1.10. DIPLOMA COURSE EQUIVALENTS

Old Courses		**New Courses**	
STD2431	Basics of Statistics	STD2431	Basics of Statistics
STD2411	The Statistical System	STD2411	The Statistical System
STD2412	Index Numbers and Time series	STD2412	Index Numbers and Time series
STD2432	Introduction to Mathematics	**MAT2432**	**Introduction to Mathematics**
STD2452	Sampling concepts in Survey work	STD2452	Sampling concepts in Survey work
STD2551	Basic Data Processing	STD2551	Basic Data Processing
STD2531	Probability	**STS3532**	**Introduction to Probability**
STD2511	Statistical Methods and Techniques	**STD2511**	**Statistical Methods and Techniques**
STD2532	Statistical Modeling	**STD2552**	**Basic Statistical Modeling**
STD2512	Basic Demography and Epidemiology	STD2512	Basic Demography and Epidemiology

F.10.1.11. DIPLOMA IN APPLIED STATISTICS: COURSES & CURRICULUM DESCRIPTION

FIRST YEAR COURSES

STD2411 THE STATISTICAL SYSTEM

Course Title: **The Statistical System**
Code: **STD2411**
NQF Level: **4**
Contact Hours: **4 lectures per week/one semester**
Credits: **16**
Course Assessment: Continuous assessment (at least **2** tests and **1** assignments**) 40%;** 1 x 3 hours Examination **60%**
Pre- requisite: **None**
Course description: Purpose and scope of official statistics, structure and work of the National Statistical System, Organization, methods and practices of data collection and dissemination. Explain the role of statistics in evidence-based policy-making. The role of statistics in National development policies and frameworks; Assessment of the National statistical system.Components of the National Statistical System and their roles; Characteristics of an effective National statistical system; Types of data and their sources. Basic concepts of national accounts:introduction to National Accounts, GDP statistics by activity, GDP by expenditure, National Income and the balance of payment, measuring GDP.

STD2431 BASICS OF STATISTICS

Course Title: **BASICS OF STATISTICS**
Code: **STD2431**
NQF Level: 4
Contact Hours: 4 Lectures per week for one semester
Number of Credits: **16**
6ourse Assessment: Continuous assessment (at least two tests and one assignments) **40%;** 1 x 3 hours Examination **60%**
Prerequisites: None
Course Description: Definitions: Statistics: descriptive versus inferential; Variables: qualitative versus quantitative; Types of data: primary versus secondary; categorical versus quantitative; discrete versus continuous, Sources of data: Population versus sample; Rationale for sampling, Sampling techniques: Probability versus non-probability; use of random numbers, Scales of measurement, Computation of numerical descriptive statistics: Measures of location: the mean, median, mode, quartiles, and percentiles; Measures of absolute dispersion: range, mean absolute deviation, standard deviation; Measures of relative variation (coefficient of variation); skewness and kurtosis, Tabular descriptive statistics: frequency distributions and cross-tabulations, Graphical descriptive statistics: bar graphs (Simple, multiple and component bar graphs); pie charts; histograms; frequency polygons; ogives; stem-and-leaf plots and boxplots.

MAT2432 INTRODUCTION TO MATHEMATICS

Course Title: **INTRODUCTION TO MATHEMATICS**
Code: **MAT2432**
NQF Level: 4
Contact Hours: 4 lectures per week/one semester,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) 4**0%**; 1x3 hours Examination **60%**
Pre- requisite: None
Course description: Sets: notations and diagrams to represent sets, subset, empty set, equality of sets, intersection, union, complement, Venn-diagrams (Population and application to word problems); Matrices: addition, multiplication, scalar multiplication and transpose (for up to 3x3 dimension), determinant and inverse (with emphasis on 2x2), Derivatives: definition, rules of differentiation; Integration: definitions, basic rules of integration and definite integrals**.** Understand the difference between sequences and series and between finite and infinite series, and appreciate the idea of a limit. Solve basic problems involving Arithmetic and Geometric Progressions. Compute both simple and compound interests, apply the concept to discounting in studying Economics. Use the Binomial Series Expansion to any power. Indices and logarithms.

STD2412 INDEX NUMBERS AND TIME SERIES

Course Title: **INDEX NUMBERS AND TIME SERIES**
Code: **STD2412**
NQF Level: 4
Contact Hours: 4 lectures per week/one semester,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1x3 hour Examination **60%**
Pre- requisite: None
Course description: Introduction to index numbers; Basic theory of index number, consumer price indices, errors in index numbers, rebasing techniques, Introduction to time series; Trends in time series; seasonal components, cyclical components, irregular component decomposing a time series; moving averages, exponential smoothing, regression, forecasting and review.

STD2452 SAMPLING CONCEPTS IN SURVEY WORK

Course Title: **SAMPLING CONCEPTS IN SURVEY WORK**
Code: **STD2452**
NQF Level: 4
Contact Hours: 4 lectures per week/one semester,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1 x 3 hours Examination **60%**
Pre- requisite: None

Course description: Identifying data needs. Importance of examining the literature to determine existing data sources, their appropriateness and their reliability. Sampling, populations and samples, Developing objectives; Designing a sampling scheme; Designing and testing a questionnaire; Data entry and data cleaning; Producing statistical summaries that relate to the objectives of the study; Presenting results What is meant by "representativeness"? The importance of getting results that is generalizable. What is meant by simple random sampling and stratified random sampling. How to draw such samples.Benefits and limitations.Probability versus non-probability sampling methods.A brief overview of quota sampling, purposive sampling, systematic sampling, cluster sampling and multi-stage sampling.Developing a sampling strategy for a given problem. Identifying information needs. Discussing alternative sampling schemes as presented by different groups. Estimating a population mean, a population proportion. Distinguishing between "with" and "without" replacement sampling.Computing measures of precision.How to take a stratified random sample.Advantages of stratification. Sample sizes using proportional allocation or Neyman's allocation. Deriving estimates for a population mean, total and proportion. Formulae for determining the sample size based on simple random sampling for estimating a population mean or population proportion. Difficulties associated with use of formulae. Recognizing broad issues that enter into sample size determinations. Key considerations needed to make decisions about sample sizes. Cluster and multi-stage sampling.Probability proportional to size (PPS) sampling.Self-weighting designs.Brief introduction to the role of design effects.Brief overview of different types of non-sampling errors. Discussion of how non-sampling errors can be minimized. Role of sampling weights in estimation.Calculation of weights for simple scenarios.

SECOND YEAR COURSES

STD2551 BASIC DATA PROCESSING

Course Title: **BASIC DATA PROCESSING**
Code: **STD2551**
NQF Level: 5
Contact Hours: 2 theoretical lectures and 2 practical lectures per week/ one semester
Number of Credits: 16
Course Assessment: Continuous Assessment (at least two tests and two assignments) **40%**, Examination **60%**. 1x3 hour Practical and theoretical Examination
Prerequisites: STD2452

Course Description: Introduction to variables and data: qualitative vs quantitative; Questionnaire design: open vs closed questions, creating variables, coding of questions; Spreadsheets: uses and limitations for data entry, organising data in a spreadsheet; Introduction to SPSS interface: Creating a database: dealing with data: creating variables, data entering, add/delete variables or cases, sort cases/variables, saving worksheet, importing data from other files e.g. Excel, efficient storage and management of databases, organising multiple response data; Data Analysis: Exploratory data analysis: creating frequency tables, graphing, descriptive statistics, crosstabulations, analysing numeric variables, presenting good tables and graphs, analysing categorical variables; Testing for relationships and associations: chis-square test, correlations; Simple regression model.

STD2511 STATISTICAL METHODS AND TECHNIQUES

Course Title: **STATISTICAL METHODS AND TECHNIQUES**
Code: **STD2511**
NQF Level: 5
Contact Hours: 4 lectures and 1 tutorial per week/one semester,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1x3 hour Examination **60%**
Pre- requisite: None

Course description: Introduction to concepts of statistical inference; Hypothesis testing:Test of significance for the means; proportionsin small and large samples (dependent and independent samples); confidence intervals for means and proportions; relationship between hypothesis testing and confidence intervals; significance levels and use of p-values as a wayof reporting results of a statistical test; One Way Analysis of Variance.

EMI3571 BASIC MICROECONOMICS

Course Title: **BASIC MICROECONOMICS**
Code: **EMI3571**
NQF Level: 5
Contact Hours: 4 lectures per week/one semester,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1x3 hour Examination **60%**
Pre- requisite: None

Course description: This course is aimed at introducing students to key concepts used in microeconomics and facilitates a basic understanding of the economic phenomena. The course is designed to help students understand that society's economic choices often involve tradeoffs between efficiency and equity and serves as preparation for students for further study of the discipline with the economics field. The course content includes: an introduction to microeconomics, demand and supply, market structures, factor markets and introduction to international trade.

STS3532 INTRODUCTION TO PROBABILITY

Course Title: **INTRODUCTION TO PROBABILITY**
Code: **STS3532**
NQF Level: 5
Contact Hours: 4 lectures and 1 tutorial per week/one semester,
Credits: 16
Course Assessment: Continuous assessment (at least two tests, two tutorial tests and two assignments) **40%**; 1X3 hour Examination **60%**
Pre- requisite: None

Course description: Basic Set theory: Definitions, Venn diagrams, Distributive Law, De Morgan's Law; Counting techniques: permutation and combination; Probability: definition using relative frequency, properties: axioms of probability, random experiments, sample space and events, addition rule, mutually exclusive events, conditional probability, total probability, Bayes Theorem and independence; Random variables: expectations, random vectors, functions of random variables and probability density in discrete and continuous case; Probability distributions: Bernoulli, Binomial, Poisson, Geometric, Uniform, Normal, Binomial and Normal tables.

STD2552 BASIC STATISTICAL MODELLING

Course Title: **BASIC STATISTICAL MODELLING**
Code: **STD2552**
NQF Level: 5
Contact Hours: 2 theoretical lectures and 2 practical lectures per week
Number of Credits: 16
Course Assessment: Continuous Assessment (at least two tests and two assignments) **40%**, 1x3 hour Examination **60%**.
Prerequisites: STD2432

Course Description: Simple Linear Regression; Inferences about the regression line; Correlation and the Coefficient of determination; Assumptions underlying regression analysis; Multiple linear regression; Choosing the best model; Predictions from the regression model; analysis of variance for comparing means; analysis of variance with two categorical factors; comparing regressions.

STD2512 BASIC DEMOGRAPHY AND EPIDEMIOLOGY

Course Title: **BASIC DEMOGRAPHY AND EPIDEMIOLOGY**
Code: **STD2512**
NQF Level: 5
Contact Hours: 4 lectures per week/one semester,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1 x 3 hours Examination **60%**
Pre- requisite: STD2411

Course description: Meaning of Demography; demographic data sources: census, vital registration, surveys and secondary sources; the need for large samples; data collection problems: sampling frame; non-response and measurement errors; concepts in demographic data collection: e.g. household, family and migration; the need for use of age-groups and conventional age-groupings; absolute versus relative numbers: ratios, proportions and rates; fertility, mortality and migration measures; meaning of Epidemiology; sources of data in the study of epidemiology: routine data, cross-sectional surveys, longitudinal and sentinel site studies; incidence and prevalence; risk factors; cohort and case-control studies.

EMA3572 BASIC MACROECONOMICS

Course Title: **BASIC MACROECONOMICS**
Code: **EMA3572**
NQF Level: 5
Contact Hours: 4 lectures per week/one semester,
Credits: 16
Course Assessment: Continuous assessment (at least two tests and two assignments) **40%**; 1x3 hour Examination **60%**
Pre- requisite: None

Course description: This course introduces basic concepts and tools used in macroeconomic analysis: the theory, measurement, and determination of national income; business cycles; the multiplier; fiscal policy; budget deficits; and the national debt; aggregate supply and aggregate demand; money, banking, and monetary policy, exchange rates and balance of payments accounts; and stabilization policy for unemployment and inflation.

F.11.DEGREE PROGRAMMES

F.11.1. REGULATION PERTAINING TO THE DEGREE PROGRAMMES

F.11.1.1. ADMISSION REQUIREMENTS

To register for a Bachelor of Science in Statistics or Population Studies Honours degree programme a candidate must hold a valid Namibian Senior Secondary Certificate (NSSC) (ordinary or higher) or a recognised equivalent qualification.

English is a **compulsory** subject and should normally have been obtained as a Second Language at NSSC (O level) with a minimum **C** symbol or English as a First Language at NSSC (O level) with a minimum **D** symbol. In addition to the above, admission to the Bachelor of Science in Statisitics or Population Studies Honours programme requires at least a symbol **C** on NSSC or equivalent qualification in Mathematics.

A candidate should obtain a minimum of **25** points on the UNAM Evaluation Point Scale in his/her five **(5)** best subjects (of which Mathematics and English must be included) to be admitted to this degree programme (Refer to the **General Admission Criteria f**or **Undergraduate Programmes** in the **General Information and Regulations Yearbook**). Obtaining the minimum number of points, however, **does not necessarily ensure admission as it is based on places available in the programme and is awarded on the basis of merit.** Nevertheless, exemption rules for students who have completed a Diploma in Applied Statistics should apply.

Admission can also be considered for persons who qualify through the Mature Age Entry Scheme upon successful completion of the relevant examinations as set out in the **General Information and Regulations Prospectus**. A special application form is available for this purpose. Such candidates may also be required to pass a Faculty entry test before admission is granted (See the Faculty of Science Admission Requirements).

Please read this section in conjunction with the academic conditions stipulated in the **General Inf**or**mation and Regulations Prospectus**.

F.11.1.2. DURATION OF STUDY

The Bachelor of Science in Statistics or Population Studies Honours degree programme cannot be completed in less than four (4) years. However, it must be completed within a period of six (6) years of full-time study, unless special permission is granted for this period to be exceeded.

F.10.1.3. MODE OF DELIVERY

The programmes are offered during the day on full-time basis. Each programme comprises of a total credit of 544 and it is at Namibian Qualification Authority (NQA) level 8.

a) Class Attendance

In order to be admitted to examinations, students are required to attend at least 80% of the lectures and to complete the required elements that make up the continuous assessment mark (Refer to the **General Information and Regulations Prospectus**).

b) Practical and tutorials

Attendance of practical and tutorial classes is compulsory for all courses that have these components.

F.11.1.4. ASSESSMENT CRITERIA

Students will be assessed by writing assignments, tests, practicals, projects and examinations. Examinations in particular will be internally moderated for year 1 and year 3 and externally moderated for year 2 and year 4. To qualify for the Examination a student should obtain a minimum of 40% continuous assessment mark and to qualify for the Supplementary/Special Examination a student should have a minimum final mark of 45% with a minimum of 40% from Examination. Examination will be administered at the end of each semester.

F.11.1.5. MINIMUM REQUIREMENTS FOR RE-ADMISSION

To be re-admitted to the Bachelor of Science in Statistics or Population Studies Honours degree programme for a particular year of registration, a student must have passed the minimum number of courses as indicated below:

- **4** courses (equivalent to **64** credits) by the end of the first year; **2** of these courses (equivalent to **32** credits) must be **non-core**,
- **8** courses (equivalent to **144** credits) by the end of the second year,
- **15** courses (equivalent to **240** credits by the end of the third year, and
- **23** courses (equivalent to **368** credits) by the end of the fourth year.

F.11.1.6. ADVANCEMENT AND PROGRESSION RULES

A student advances to the following academic level of study when at least 2/3 of the modules of the curriculum for a specific year have been passed. If a student passed only 1/3 of the full curriculum of a specific year, he/she may not register for any modules of the following year. In all cases, prerequisites for modules have to be passed before a student can proceed to register for modules that require prerequisites.

- **From year 1 to year 2:**
  At least **8** modules (equivalent to a minimum of **128** credits) prescribed for year 1.

- **From year 2 to year 3:**
  All first year modules plus at least **6** modules (equivalent to a minimum of **86** credits) prescribed for year 2.

- **From year 3 to year 4:**
  All second year modules plus at least **6** modules (equivalent to a minimum of **86** credits) prescribed for year 3.

F.11.1.7. MAXIMUM NUMBER OF COURSES PER YEAR

A part-time student can only register for **75%** of the prescribed courses in any given academic year. Full-time students can register for all first year courses and thereafter, no more than **10** courses in any academic year.

F.11.1.8. ARTICULATION ROUTE

These qualifications serve as an entry point to the Master of Science in Applied Statistics and Demography when a student graduates with a minimum of a lower second class (**60-69%** average). In addition, a student joining the Bachelor of Science in Statistics or Population Studies Honours degree after completing the Diploma in Applied Statistics from the University of Namibia or any equivalent qualification may be exempted from certain year 1 courses of the degree program. The courses are as follows:

Course passed	**Exemption**
STS3532 Introduction to Probability	STS 3532 Introduction to Probability
STD 2512 Basic Demography and Epidemiology	POP3512 Fundamentals of Population Theory
LEG2410 English for General Communication	LCE3419 English Communication & Study Skills
CLC3509 Computer Literacy	CLC3509 Computer Literacy
CSI3580 Contemporary Social Issues	CSI3580 Contemporary Social Issues

F.12.DEGREE ARTICULATION PROGRAMMES

F.12.1. PURPOSE AND REGULATION PERTAINING TO THE ARTICULATION DEGREE PROGRAMMES

F.12.1.1. PURPOSE

BACHELOR OF SCIENCE IN STATISTICS HONOURS (11BSCA)

The purpose of this qualification is to provide an opportunity for holders of a level 7 degree in Statistics or a pre-NQF degree in Statistics to upgrade to a level 8 honours degree.

BACHELOR OF SCIENCE IN POPULATION STUDIES HONOURS (11BSPA)

The purpose of this qualification is to provide an opportunity for holders of a level 7 degree in Population Studies or a pre-NQF degree in Population Studies to upgrade to a level 8 honours degree.

F.12.1.2. ADMISSION REQUIREMENTS

BACHELOR OF SCIENCE IN STATISTICS HONOURS (11BSSA)

1) The applicant must be in possession of EITHER

a) a BSc degree in Statistics at NQF level 7.

OR

b) a pre-NQF BSc degree in Statistics or equivalent qualification from a recognized institution.

2) Students who have completed a double major Bachelors degree may be required to register for a number of undergraduate modules for non-degree purposes in order to gain admission into this programme.

BACHELOR OF SCIENCE IN POPULATION STUDIES HONOURS (11BSAP)

1) The applicant must be in possession of EITHER

c) a BSc degree in Population Studies at NQF level 7.

OR

d) a pre-NQF BSc degree in Population Studies or equivalent qualification from a recognized institution.

2) Students who have completed a double major Bachelors degree may be required to register for a number of undergraduate modules for non-degree purposes in order to gain admission into this programme.

F.12.2. DURATION OF STUDY

For both articulation programmes, the minimum duration of the study is one year and the maximum duration is two years.

F.12.3. MODE OF DELIVERY

The programmes are offered during the day on full-time basis on the Main Campus of UNAM.

F.12.4. ASSESSMENT CRITERIA

A candidate will be eligible to write the final examination if he/she has obtained the required continuous assessment (CA) mark of 40%. A combination of continuous assessment (50%) and an examination (50%) will be used to assess each of the typical modules in this program and details are further specified under respective module descriptors. Assessment criteria are based on written examinations, written tests, assignments, research reports, oral examinations, and seminar presentations. Attendance of lectures and tutorial classes is compulsory (at least 80%).

F.12.5. MINIMUM REQUIREMENTS FOR RE-ADMISSION

To be re-admitted to the Faculty of Science for a second year of registration, a student must have passed a minimum of 64 credits by the end of the first year.

F.12.6. ADVANCEMENT AND PROGRESSION RULES

Not applicable as this is a one-year program.

F.12.7. MAXIMUM NUMBER OF COURSES PER YEAR

A student will not be allowed to register for more than 134 credits. This qualification will be awarded to candidates who passed all prescribed modules in the curriculum framework.

F.12.8. ARTICULATION ROUTE

For the Statistics option, the qualification may serve as an entry point to an MSc degree in Statistics/ MSc in Biostatistics or its equivalents. For the Population Studies group, the qualification may serve as an entry point to an MSc degree in Demography or Population Studies or related qualifications.

F.13. STATISTICS AND POPULATION STUDIES NEW CURRICULUM & PREREQUISITES

F.13.1 QUALIFICATION: B.SC. STATISTICS HONOURS (11BSCS)

Students opting for a Bachelor of Science in Statistics Honours degree must take all of the following courses:

YEAR 1

COURSE CODE	COURSE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 1 Semester 1					
LCE3419	English Communication & Study Skills	**4**	16		None
STS3531	Descriptive Statistics	**5**	16		None
CLC3509	Computer Literacy	**5**	8		None
MAT3511	Basic Mathematics	**5**	16		None
MAT 3521	Matrices & Complex Numbers	**5**	8		None
MAT3501	Analytical Geometry	**5**	8		None
Year 1 Semester 2					
LEA3519	English for academic Purpose	**5**	16		None
CSI 3580	Contemporary Social Issues	**5**	8		None
MAT3512	Precalculus	**5**	16		None
STS3532	Introduction to Probability	**5**	16		None
MAF 3532	Basic Financial Mathematics	**5**	16		None
Total			**144**		

YEAR 2

COURSE CODE	COURSE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 2 Semester 1					
STS3611	Probability Theory	**6**	16	STS3532, MAT3512	None
STS3671	Statistical Methods	**6**	16	STS3532	None
MAT3611	Calculus I	**6**	16	MAT3512	None
MAT3661	Sets and Logic	**6**	8	MAT3511	None
MAT3641	Numerical Methods with MATLAB	**6**	8	MAT3521	None
MAF3651	Financial Mathematics I	**6**	16	MAF3532	None
Year 2 Semester 2					
STS3652	Fundamentals of Statistical Computing	**6**	16	STS3531	None
MAT3612	Calculus II	**6**	16	MAT 3512	None
STS3672	Distribution Theory	**6**	16	STS3532	STS3611 & MAT3611
MAT3652	Elementary Linear Algebra	**6**	16	**Any full Mathematic course at first year and MAT3521**	None
Total6			**144**		

YEAR 3

COURSE CODE	COURSE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 2 Semester 1					
STS3741	Non-Parametric & Categorical Statistics	**7**	8	None	None
STS3771	Statistical Inference	**7**	16	STS3671	None
STS3731	Sampling Techniques	**7**	16	STS3531	None
MAT3711	Linear Algebra I	**7**	16	(MAT3611 or MAT3612) and MAT3661 and MAT3652	None
Year 2 Semester 2					
STS3732	Data processing	**7**	16	STS3652	STS3771

STS3752	Experimental Design and Analysis of Variance	**7**	16	STS3672	STS3771
MAT3712	Linear Algebra II	**7**	16	(MAT3611 or MAT3612) and MAT3661 and MAT3652	None
STS3702	Research and Survey Methods	**7**	8	None	None
STS3772	Linear Models	**7**	16	STS3671	STS3771
Total			**128**		

YEAR 4

COURSE CODE	COURSE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 4 Semester 1					
STS3871	Survival Analysis	**8**	16	STS3671	None
STS3851	Operational research	**8**	16	STS3772	None
STS3810	Research Project	**8**	32	**Registered as a fourth year students and STS 3732**	None
Year 4 Semester 2					
STS3831	Stochastic Processes	**8**	16	STS3672, STS3771	None
STS3812	Multivariate Distribution Theory	**8**	16	STS3672, STS3771	None
STS3872	Time series and forecasting	**8**	16	STS3772	None
STS3832	Statistical Quality Control	**8**	16	STS3672, STS3771	None
Total			**128**		

F.13.2. QUALIFICATION: B.SC. IN POPULATION STUDIES HONOURS 11BSPO

Students opting for a Bachelor of Science Honours in Population Studies degree must take all of the following courses:

YEAR 1

COURSE CODE	COURSE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 1 Semester 1					
LCE3419	English Communication & Study Skills	**4**	16		None
STS3531	Descriptive Statistics	**5**	16		None
CLC3509	Computer Literacy	**5**	8		None
MAT3511	Basic Mathematics	**5**	16		None
Year 1 Semester 2					
LEA3519	English for academic Purpose	**5**	16		None
CSI3580	Contemporary Social Issues	**5**	8		None
MAT3512	Precalculus	**5**	16		None
STS3532	Introduction to Probability	**5**	16		None
POP3512	Fundamentals of Population Theory	**5**	16		None
Total			**128**		

YEAR 2

COURSE CODE	COURSE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 2 Semester 1					
POP3631	Official Statistics and National Statistical Systems	**6**	16	None	None
POP3611	Introduction to Demography	**6**	16	None	None
STS3611	Probability Theory	**6**	16	STS3532, MAT3512	None
STS3671	Statistical Methods	**6**	16	STS3532	None
SOG3671	Social Problems: Learning to Conceptualize and Implement Research	**6**	16	None	None
Year 2 Semester 2					
STS3652	Fundamentals of Statistical Computing	**6**	16	STS3531	None
POP3612	Epidemiological Methods	**6**	16	None	None
SOG3632	Sociology of Development	**6**	16	None	None
POP3632	Fundamentals of Population and Development	**6**	16	POP3512	None
Total			**144**		

YEAR 3

COURSE CODE	COURSE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 3 Semester 1					
POP3731	Fundamentals of Data Processing	**7**	16	STS3652	None
STS3731	Sampling Techniques	**7**	16	STS3531	None
GIS3711	Geographical Analysis and Techniques	**7**	16	None	None
STS3741	Non-Parametric & Categorical Statistics	**7**	8	None	None
POP3711	Demographic Methods I	**7**	16	POP3611	None
GIS3732	Geographical Information System	**7**	16		HGIS3711
SOG3732	Social Research Methods	**7**	16	None	None
POP3732	Demographic Methods II	**7**	16	POP3611	POP3711
STS3772	Linear Models	**7**	16	STS3671	None
STS3702	Research and Survey Methods	**7**	8	None	None
Total			**144**		

YEAR 4

COURSE CODE	COURSE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 4 Semester 1					
SOS3860	Sociology of Gender and Sexuality	**8**	8	Admission to the 4th year level	None
POP3810	Research Project	**8**	32	Registered as a fourth year students and POP3731	None
POP3831	Monitoring & Evaluation Techniques	**8**	16	None	None
STS3871	Survival Analysis	**8**	16	STS3671	None
Year 4 Semester 2					
POP3872	Population Migration and Urbanization	**8**	16	POP3732	None
POP3852	Population Projections	**8**	16	POP3732	None
POP3812	Indirect Estimation	**8**	16	POP3731, POP3732	None
Total			**128**		

F.13.3 QUALIFICATION: B.SC. IN STATISTICS HONOURS 11BSSA

Students opting for a Bachelor of Science in Statistics degree must take all of the following courses, all at 4th year level:

YEAR 1

COURSE CODE	COURSE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
STS3871	Survival Analysis	**8**	16	None	None
STS3851	Operational research	**8**	16	None	None
STS3880	Research Methodology and Project	**8**	38	None	None
STS3831	Stochastic Processes	**8**	16	None	None
STS3812	Multivariate Distribution Theory	**8**	16	None	None
STS3872	Time series and forecasting	**8**	16	None	None
STS3832	Statistical Quality Control	**8**	16	None	None
Total			**134**		

F.13.4. QUALIFICATION: B.SC. IN POPULATION STUDIES HONOURS 11BSAP

Students opting for a Bachelor of Science Honours in Population Studies degree must take all of the following courses, at 4th year level:

YEAR 1

COURSE CODE	COURSE	NQF LEVEL	CREDITS	PRE-REQUISITES	CO-REQUISITES
SOS3860	Sociology of Gender and Sexuality	**8**	8	None	None
POP3880	Research Methodology and Project	**8**	38	None	None
POP3831	Monitoring & Evaluation Techniques	**8**	16	None	None
STS3871	Survival Analysis	**8**	16	None	None
POP3872	Population Migration and Urbanization	**8**	16	None	None
POP3852	Population Projections	**8**	16	None	None
POP3812	Indirect Estimation	**8**	16	None	None
Total			**134**		

F.13.5 STATISTICS AND POPULATION STUDIES COURSE AND CURRICULUM DESCRIPTIONS

FIRST YEAR COURSES

STS 3531 DESCRIPTIVE STATISTICS

NQF Level 5
NQF Credits : 16
Course assessment: **Continuous assessment** (at least two tests, two tutorial test and two assignments) **40%**; Examination **60%** (1x3 hour Examination paper)
Pre-requisite: None
Contact hours: 4 lectures plus 1 hour tutorial per week/one semester
Course Descriptiont: Data types: Categorical versus discrete and Continuous versus numerical; Data sources: Primary versus secondary; Types of measurements: Nominal, ordinal, interval and ratio Scales; Collection and presentation of data: Tabular forms; frequency tables, cross-tabulations (two variables), Graphical methods; bar charts, histogram, pie charts, frequency polygons, stem-and-leaf plots, box and whiskers plot, ogives; Identifying outliers; Measures of central tendency: Mean, median, mode, quartiles; Measures of dispersion: Skewness and kurtosis; variance, standard deviation, range, inter-quartile range.

STS 3532 INTRODUCTION TO PROBABILITY

NQF Level : 5
NQF Credits: 16
Course assessment: **Continuous assessment** (at least two tests, two tutorial test and two assignments) **40%**; Examination **60%** (1x3 hour Examination paper)
Pre-requisite: None
Contact hours: 4 lectures plus 1 hour tutorial per week/one semester
Course Description: Basic Set theory: Definitions, Venn diagrams, Distributive Law, De Morgan's Law; Counting techniques: permutation and combination; Probability: definition using relative frequency, properties: axioms of probability, random experiments, sample space and events, addition rule, mutually exclusive events, conditional probability, total probability, Bayes Theorem and independence; Random variables: expectations, random vectors, functions of random variables and probability density in discrete and continuous case; Probability distributions: Bernoulli, Binomial, Poisson, Geometric, Uniform, Normal, Binomial and Normal tables.

POP 3512 FUNDAMENTAL OF POPULATION THEORY

NQF Level: 5
NQF Credits: 16
Course assessment: **Continuous assessment** (at least two tests, two tutorial test and two assignments) **40%**; Examination **60%** (1x3 hour Examination paper)
Prerequisite:
Contact hours: 4 lectures per week/one semester
Course Description Concepts of population theories; The need for population studies; Pioneers in the discussion of population issues; Development of Demography as a field of study; Definitions of terminologies used in Demography; The genesis of population studies from the mercantilist theories through the Malthusian, Neo-Malthusian theories and Marxist viewpoints, and present-day perspectives; History of population growth culminating in mid-20th century terminologies like population being a time-bomb; Common population theories that have come into being; Part played by such theories in current world affairs; Use of population pyramids and rates and ratios in understanding population structure

SECOND YEAR COURSES

STS 3611 PROBABILITY THEORY

NQF Level: 6
NQF Credits: 16
Course assessment: **Continuous assessment** (at least two tests, two tutorial test and two assignments) **40%**; Examination **60%** (1x3 hour Examination paper)
Pre-requisite: STS3532 and MAT3512
Contact hours: 4 lectures plus 1 hour tutorial per week/one semester
CourseDescription: Random variables: Distribution functions, probability densities and their relationships, basic properties, quantiles of a distribution; Moments of random variables: Moments of random variables, Expectations and variances of random variables, Expectations of a function of random variables Moment generating functions of random variables; Discrete probability distributions: Binomial, Poisson, Geometric, Hypergeometric, Negative binomial. Expectations and variances of selected discrete probability distributions; Continuous random variables and their probability distributions: Uniform, Exponential, Normal. Expectations and variances of selected continuous probability distributions; Approximation of distributions: Binomial to Poisson, Binomial to Hypergeometric, Binomial to normal, Poisson to normal, Covariance and correlation; Bivariate and multivariate probability distributions: Marginal and Conditional probability distributions, Independent random variables; Convergence in probability and distribution: Law of large number, Central Limit Theorem.

STS 3671 STATISTICAL METHODS

NQF Level: 6
NQF Credits: 16
Course assessment: **Continuous assessment** (at least two tests, two tutorial test and two assignments) **40%**; Examination **60%** (1x3 hour Examination paper)
Pre-requisite: STS3532
Contact hours: 4 lectures plus 1 hour tutorial per week/one semester

Course Description: Sample statistics and sampling distributions: Sampling distributions related to the Normal distribution, the Central Limit Theorem; Estimation of parameters: Point estimation; Confidence intervals: for means, proportions, difference in means and proportions; the ratio of two variances; Hypothesis testing: test of significance for means; proportions and variance: In small and large samples(dependent and independent samples); Chi-square tests; Calculating type II error probabilities and finding the sample size for the Z test; relationship between hypothesis testing procedure and confidence intervals; Significance levels and p-value as way of reporting results of a statistical test; Testing hypotheses concerning variances; power of tests.

STS 3652 FUNDAMENTAL OF STATISTICAL COMPUTING

NQF Level: 6
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3 hour Practical Examination paper: project using real data assessed through presentation and written report).
Pre-requisite: STS3531
Contact hours: 4 lectures plus 3 hour practical per week/one semester

Course Description: Introduction to statistical packages: SPSS, Excel for analysis, Stata; Data acquisition and management: Transferring information from paper form to electronic Form; Create datasets: variable definition, variable labels, data entry, data cleaning, selecting cases, split files. Import/copying files, tables from excel, SPSS to word; Data Analysis: Descriptive statistics; Graphical representation-editing, cross tabulation, estimation and hypothesis testing using a statistical package.

STS 3672 DISTRIBUTION THEORY

NQF Level: 6
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Co-requisite: STS3611 and MAT3611
Contact hours: 4 lectures plus 1 hour tutorial per week/one semester

Course Description: Further probability distribution functions: Bivariate Normal, Gamma, Chi-square, Beta, F and t distributions. Moments of Bivariate Normal, Gamma, Chi-square, Beta, F and t distributions; Functions of random variables: Sum, difference, product and quotient; Methods of Distribution functions: distribution of minimum and maximum, sum and differences, products and quotients; Method of Transformations: probability integral transform, transformation of discrete r.v.s, transformation of continuous r.v.s; Method of Moment-generating functions and related generating functions (characteristic functions, factorial moment generating functions of random variables): sum of independent random variables; Sampling and limiting distributions: Sample mean, sampling from normal distribution: t and F distributions; Mixture and hierarchical distributions; Order statistics and their functions.

POP 3631 OFFICIAL STATISTICS AND NATIONAL STATISTICAL SYSTEM

NQF Level: 6
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Prerequisite: None
Contact hours: 4 lectures per week/one semester

Course Description: Explain the Purpose and scope of official statistics; Explain and discuss structure and work of the National Statistical System, its Organization, methods and practices of data collection and dissemination of Official Statistics; Social Statistics: Define educational levels, purpose, principles and procedures with respect to education statistical data collection, Understand and appreciate data requirement for educational development purposes, Understand and appreciate various rate and ratios required for analysis of statistics on teacher and pupils: Understand definition and scope of health related statistical issues, Understand statistics on medical facilities and uses of hospital records, Comprehend basic ideas of epidemiological issues and indicators of health, Understand and define scope of housing statistics, Understand the importance of statistics related to: definition of a dwelling unit, housing condition, housing needs requirements, Understand labour and employment statistics: Explain how the following statistics are defined and calculated: labour force, economically active and inactive population, employment rates etc, Understand the importance of statistics on wages, labour income, social security, underemployment etc; Understand the importance of: Trade statistics, Migration statistics, Civil registration statistics, Economic statistics; Concept and measure of poverty; Poverty line: Economic growth versus population growth; System of national accounts (SNA): Explain the importance of compiling national accounts; Explain the uses of national accounts in socio-economic planning; Millennium Development Goals (MDGS); National Development Goals (NDP).

POP 3611 INTRODUCTION TO DEMOGRAPHY

NQF Level: 6
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Prerequisite: None
Contact hours: 4 lectures per week/one semester

Course Description: Population trends: Demographic transition theory, Population trends in the world and Namibia in particular, Population size and composition, World population conferences; Population change: Components of population change, the population balancing equation, Decomposition and synthesis of demographic components to explain or to estimate population change; Fertility: Definitions and key concepts in fertility, Sources of data for fertility analysis, Levels, trends and differentials of fertility, Major macro level fertility theories and models, Micro level perspectives of fertility, Economic, psychological; socio-cultural explanations of fertility levels, Recent changes in fertility patterns in developing countries, Fertility policies and programmes; Mortality: Definitions and key concepts in mortality, Sources of data for mortality analysis, Levels and trends of mortality, Differentials and Determinants, Recent changes in mortality levels and patterns in developing countries, Mortality policies and programmes in developing countries, Emerging and re-emerging diseases and their effects on mortality patterns, Impact of HIV; Migration: Definitions and key concepts in migration, Migration theories, Description and explanation to migration patterns, Consequences of migration at place of origin and place of destination.

SOG 3671 SOCIAL PROBLEMS: LEARNING TO CONCEPTUALIZE AND IMPLEMENT RESEARCH

NQF Level: 6
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Prerequisite: None
Contact hours: 4 lectures per week/one semester

Course Description: The course resumes the methodological training introduced into the sociology curriculum with the 1st year course "Basics of Sociology". It familiarizes the student with the use of social science research methods to identify, formulate, and study social problems (class, poverty and inequality; gender inequality; crime and violence; alcohol and substance abuse; HIV/AIDS and other health issues; environmental problems etc). At lower intermediate level, the course is the second in a sequence of three Courses aimed at imparting theoretical knowledge, conceptual capabilities and practical skills in social research that are needed for adequate professional preparation. Practical acquaintance with the field, however, will be reserved for a further course at upper intermediate level, in the following year of studies.

SOG 3632 SOCIOLOGY OF DEVELOPMENT

NQF Level: 6
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Prerequisite: None
Contact hours: 4 lectures per week/one semester

Course Description: Key theories, themes and case studies on social and economic development will be introduced to the student with the intention of explaining the causes of underdevelopment and alternatively, successful development; Classical, modernization, dependency, organisational, regulationist and post-material theories will be critically examined; Historical dimensions of development will be included in relation to: rise of industrial societies, colonial impacts, the emergence of the global economy; Themes will be: measuring development and poverty, international aid, Asian economies including China, population, urbanisation and migration, politics and development, NGO and inter-governmental assistance, sustainable development; These will be: applied to Namibian contexts, including explanations and solutions of restricted development in the African continent. Group work will be undertaken.

POP 3632 FUNDAMENTAL OF POPULATION AND DEVELOPMENT

NQF Level: 6
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Prerequisite POP3512
Contact hours: 4 lectures plus 1 hour tutorial per week/one semester

Course Description: Examination of the relations between population and development and their potential consequences from a sociological, economic and geographical perspective; Global variation in population size and growth; Various demographic perspectives and their modern implications; Environmental impacts and population policy; Conceptual framework for development planning: Overview of the framework, institutions and principal variables; Economic-demographic interaction, Effects of population change on socio-economic variables (Supply of goods and services; demand for goods and services, distribution of income), Effects of socio-economic change on demographic variables (fertility (marriage), mortality, migration); Gender and Development; Health and Development; Social change and Development; Culture and Development; Measuring Development.

POP3612 EPIDEMIOLOGICAL METHODS

NQF Level: 6
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Prerequisite: None
Contact hours: 4 lectures plus 3 hour practical per week/one semester

Course Description: Scope of Epidemiological enquiry: Overview of main problem areas; Measuring occurrence of disease: Incidence, Prevalence, Choice of measure, Comparing rates, Standardization; Studying association between risk factors and disease: Which type of studies Ecological and migrant studies; Clinical trials: Non-randomized design, Randomization, Randomized designs: Parallel and Cross-over designs; Case control design: Advantages and Disadvantages recruitment of cases and controls. One or two control groups, Matched case control design, reasons for matching: advantages and disadvantages relative to unmatched studies; Cohort (prospective) studies: advantages and disadvantages. Selection of subjects for cohort (longitudinal studies); Cross-sectional studies design: Advantages and disadvantages; Identification of the population (Representativeness, Access, Data accuracy, Study size). Use of cross-sectional population surveys to assess incidence; Combination of study designs: Nested cohort design; Which measure of association? Measures of association and impact: risk difference, relative risk and odds ratio, Attributable risks; Bias: Selection and information bias, effects of the various forms of bias on estimation; Confounding and effect modification: its determination and control.

THIRD YEAR COURSES

STS3741 NON-PARAMETRIC AND CATEGORICAL DATA ANALYSIS

NQF Level 7
NQF Credits 8
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x2hour Examination paper).
Pre-requisite None
Contact hours: 2 lectures plus 1 hour tutorial per week/one semester

Course Description: Goodness of fit tests: Chi- square test, Kolmogorov – Smirnov test; Nonparametric statistics, nonparametric tests: Median tests, Sign test, Wilcoxon Signed Rank test, Mann – Whitney U test, Kruskal – Wallis H test, Friedma's test, Spearman Rank Correlation test; Contingency tables: inferences for two way contingency tables: chi-square tests of independence, comparing proportions: difference in proportions, odds ratio and risk ratio; Trend test, Test for correlated contingency table; Summary measures of association: binary variables: phi and Cramer's V; ordinal measure of association: Kendall's tau, Goodman and Kruskal's gamma, Somer's d; nominal measures of association; Summary measures of agreement: kappa; Models for a binary and count response variable: Logistic regression and log linear models.

STS3731 SAMPLING TECHNIQUES

NQF Level 7
NQF Credits 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Pre-requisite **STS3531**
Contact hours: 4 lectures plus 1 hour tutorial per week/one semester

Course Description: Data collection methods: probability and non-probability methods. Response and non-response errors. Estimation of population mean, population total, population proportion and population variance. Sample size allocation in: simple random sampling (with and without replacement), stratified random sampling, systematic sampling, cluster sampling (two-stage), quota sampling, judgemental sampling, and snowball sampling. Calculation of sampling and Non-sampling errors.Confidenceinterval.Weighting.

STS3771 STATISTICAL INFERENCE

NQF Level 7
NQF Credits 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Pre-requisite STS3671
Contact hours: 4 lectures plus 1 hour tutorial per week/one semester

Course Description: Properties of estimators: unbiased, minimum variance estimators, mean square error, and some common unbiased point estimator; efficiency: relative efficiency, full efficiency and Cramer- Rao lower bound, sufficiency and the Rao-Blackwell theorem; large sample properties: consistency; Method of estimation: the method of moments, the method of least squares, the method of maximum likelihood, Bayesian estimation; Nonparametric methods: robust estimation, bootstrap. The Neyman-Pearson Lemma; Likelihood Ratio Tests. Linear models and estimation by least squares: an introduction; measures of association between variables.

STS3732 DATA PROCESSING

NQF Level 7
NQF Credits 16
Continuous assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3 hour Practical Examination paper: project using real data assessed through presentation and written report).
Pre/Co-requisite : Pre: STS3652 and Co: STS3771
Contact hours: 4 lectures plus 3 hour practical per week/one semester
Course Description: Applications of inferences concerning means and proportions to data; Parametric tests: t- test, Chi-Square Goodness of Fit and Independence tests, ANOVA tests and Post- hoc tests; Testing for Assumptions: Kolmogorov- Smirnov test for Normality, Levene's tests for Equality and Homogeneity of Variance; Nonparametric tests: Binomial test, Sign Test, Wilcoxon Signed-Ranks test, Mann- Whitney Test, Kruskal – Wallis test, Friedman's test, Spearman Rank Correlation test; Application of Simple Linear Regression (modelling) to Data; Mini project.

STS3702 RESEARCH AND SURVEY METHODS

NQF Level: 7
NQF Credits: 8
Continuous assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x2 hour Examination paper).
Pre-requisite: None
Contact hours: 2 lectures per week/one semester
Course Description: Formulation of: Research problem, Research questions, Research hypotheses, Research questions, research hypotheses; Methods of collecting data: Methods that can be applied in data collection (e.g. primary versus secondary data), The need for sampling versus conducting a census, Sampling techniques and their advantages and disadvantages, Ethical issues in research, Possible sources of errors in survey work, Necessity of pilot surveys prior to actual data collection work, Characteristics of a good questionnaire, Methods of administering a questionnaire, Advantages and disadvantages of various methods of administering a questionnaire; Data processing: Data cleaning, How to deal with non-responses, Coding, Choice of techniques to summarise data, Analytical tools to employ for qualitative and quantitative research; Report writing: Scientific language in report writing, Essential components of a research Report, Citing other works versus plagiarism.

STS3772 LINEAR MODELS

NQF Level: 7
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Pre/Co-requisite: Pre: STS3671 and Co: STS3771
Contact hours: 4 lectures plus 3 hour practical per week/one semester
Course Description: Linear models and estimation: fitting a simple linear model, multiple regression; Inference: statistical inference of linear models; Regression analysis: Polynomial and nonlinear regression, Residual analysis, Multicollinearity and its effects; Diagnostics and remedial measures; Model building: Enter method, Stepwise procedure, Backward procedure, Forward method; Model validation.

STS3752 EXPERIMENTAL DESIGN AND ANALYSIS OF VARIANCE

NQF Level 7
NQF Credits 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Pre/Co-requisite Pre: STS3692 and Co: STS3771
Contact hour: 4 lectures plus 3 hour practical per week/one semester
Course Description Experimental designs: Factorial designs, Latin squares design, Graeco-Latin squares design; Analysis of Variance: One-way ANOVA, Two-way ANOVA; Multiple comparisons: Multiple comparison methods; Incomplete designs and missing values: Analysis involving incomplete tables missing observations.

POP3731 FUNDAMENTAL OF DATA PROCESSING

NQF Level: 7
NQF Credits: 16
Continuous assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3 hour Practical Examination paper).
Prerequisite: STS3652
Contact hour: 4 lectures plus 3 hour practical per week/one semester
Course Description: Introduce students to parametric and non-parametric tests; Introduction to regression analysis: Linear regression and Correlation; Explaining the relationship between variables using a Scatter plot; Fitting a simple linear regression model and test of hypothesis for regression coefficient; Testing the association between variables using the correlation analysis; Introducing multiple linear regression analysis: model selection techniques: forward, backward, stepwise; categorical variables in regression; Generalized Linear models: parameter estimation, interpretation; Logistic regression analysis: parameter estimation; interpretation of odds ratio; estimated probabilities.

GIS3711 GEOGRAPHICAL ANALYSIS AND TECHNIQUES

NQF Level: 7
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **60%**; Examination **40%** (1x3hour Examination paper).
Prerequisite: None
Contact hour: 4 lectures per week/one semester

Course Description: This course introduce students to concepts, methods and techniques in Geography; methodological paradigms in Geographical Research and problem formation and research design, that seek to provide an understanding about the complexity that implies the generation of scientific knowledge. It also introduces students to the nature of cartography that focuses on the nature of geographical data and, more specifically, the transformation of spatial and non-spatial data into different forms of media such as maps, aerial photographs or satellite images. Other contents includes: map compilation & interpretation, basic Geodesy, map projection and spatial statistics.

POP3711 DEMOGRAPHIC METHODS I

NQF Level: 7
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Prerequisite: POP3611
Contact hour: 4 lectures per week/one semester

Course Description: Sources and types of demographic data: Population census, sample surveys, vital registration, population register, non-traditional sources (parish register, administrative records), international sources; Uses and limitations of demographic data; Availability of population data in sub-Saharan Africa; Evaluation of demographic data: Errors in demographic data and techniques of detecting these errors, Data adjustment techniques, Techniques of estimating population size and composition; Understanding the concepts of the Basic demographic methods: the balancing equation; Demographic measures: Dependency ratio, Age and economic dependency ratios and their implications, Estimation and measurements of basic Demographic parameters: fertility, mortality and migration

GIS3732 GEOGRAPHICAL INFORMATION SYSTEMS

NQF Level: 7
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **60%**; Examination **40%** (1x3hour Examination paper).
Co-requisite: HGIS3711, Placement test
Contact hour: 4 lectures per week/one semester

Course Description: This course introduces students to various basic concepts of geographical information systems, examining both local and global GIS trends. Topics includes: introduction to GPS, projection and distortions, basic and practical understanding of GIS concepts, techniques and real world applications; utilization of GIS in the larger context of geography and other applications; basic concepts of geography necessary to efficiently and accurately use GIS technology; GIS data models and concepts.

POP3732 DEMOGRAPHIC METHODS II

NQF Level: 7
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Pre/Co-requisite: Pre: POP3611, Co: POP3711
Contact hour: 4 lectures per week/one semester

Course Description: Measurements of Mortality: CDR, ASDR, (q-type and m-type mortality rates); Standardization: standardized death rate, standardized mortality ratio, standardized fertility ratio, standardized birth rate; Understanding the Lexis chart; Frameworks and models for mortality analysis; Measurements of fertility: CBR, ASFR, TFR, Period and Cohort analysis of fertility Parity progression; Explaining the determinants of fertility; Frameworks and models for fertility analysis; Understanding the Life table: the theory of the life table, abridged life tables, multiple decrement life tables; Mortality Models - UN model Life Tables, Coale and Demeny regional model life tables, Ledermann's and Brass logit life tables etc.

SOG3732 SOCIAL RESEARCH METHODS

NQF Level: 7
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **60%**; Examination **40%** (1x3hour Examination paper).
Prerequisite: None
Contact hour: 4 lectures per week/one semester

Course Description: This course is designed to introduce students to the application of social research. The students will acquire fundamental knowledge and understanding of the concepts and techniques of social research and will develop the ability to apply their acquired skills to practical social research. The course covers basic research concepts and theoretical debates that underlie different research approaches. The topics include among others; basic concepts and philosophical models of research, the role of theory in research, types of research, research model, reliability and validity, measurements, index scale and construction, sampling and methods of data collection and data analyses.

FOURTH YEAR COURSES

STS3851 OPERATIONAL RESEARCH

NQF Level:	8
NQF Credits:	16
Course assessment:	Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Pre-requisite:	STS3772
Compulsory/Elective:	Compulsory
Contact hour:	4 lectures plus 1 hour tutorial per week/one semester

Course Description: Decision Analysis: Types of decision problems; Decision-making under uncertainty: basic concepts; Ways of expressing outcomes: Payoffs and opportunity losses, Characterizing the uncertainty in decision problems, Solving decision problems using the expected payoff criterion and the expected utility criterion, Classifying decision makers by their utility functions; Revising state of nature probabilities: Decision trees; Bayes' rule: solving decision problems using posterior probabilities; Deterministic EOQ Inventory models; Introduction: type of inventory models, costs involved, Assumptions, Basic Economic Order Quality model: assumptions, derivation, determination of EOQ when holding cost, the effect of a non-zero lead time, power-of-two ordering policies; Probabilistic inventory models: Basic concepts: single-period models, the concept of marginal analysis, Discrete versus continuous demands; Deterministic dynamic programming (Network models): Basic concepts; Network models: minimal-spanning tree technique, maximal-flow technique, shortest-route technique.

STS3831 STOCHASTIC PROCESSES

NQF Level:	8
NQF Credits:	16
Course assessment:	(at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Pre-requisite:	STS3692
Contact hour:	4 lectures plus 1 hour tutorial per week/one semester

Course Description: Conditional Probability and conditional expectations; Elements of Stochastic Processes: Definition, Stationarity, finite –dimensional distributions, versions and modification; Markov Chains in discrete time and Markov Chains in continuous time: The basic limit theorem of Markov chains and applications, Classification of states, Limiting probabilities, Branching processes; The Poisson Processes: Counting process, Compounding stochastic processes Queuing processes; Gaussian distribution: for variables, vectors and processes; Brownian motion and Branching Processes: Definition, Gaussian construction, independence of increments Geometric Brownian motion, Brownian Bridge and Ornstein-Uhlenbeck process.

STS 3880 RESEARCH METHODOLOGY AND PROJECT

NQF Level:	**8**
NQF Credits:	38
Course assessment:	Continuous assessment **100%** (Oral presentation **20%** and Project report **80%** (Internal assessment **40%** and External assessment **40%**))
Prerequisite:	Registered as a fourth year students
Compulsory/Elective	Compulsory
Contact hour:	2 lectures per week/two semesters

Course Description: Research Methodology: Planning and Designing a Research Study; General Types of Research Designs and Approaches; Data Collection, Assessment Methods, and Measurement Strategies; Data Preparation, Analyses, and Interpretation; Ethical Considerations in Research; Disseminating Research Results and Distilling Principles of Research Design and Methodology.
Research Project: A final year project on a selected topic demonstrating the applications of relevant demographic and statistical methods culminating in a project report. The module runs throughout the two semesters. Students work under supervision of a member of the academic staff of the department. When possible students may be attached to relevant industries/institutions etc.

STS3871 SURVIVAL ANALYSIS

NQF Level:	8
NQF Credits:	16
Course assessment:	Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3 hour Examination paper).
Pre-requisite:	STS3671
Contact hour:	4 lectures plus 1 hour tutorial per week/one semester

Course Description: Concepts in Survival Analysis; Nature of survival data: common assumptions, censoring and truncation, Calendar time and study time; Functions that describe survival: some commonly used survival functions, fully parametric and nonparametric methods; Introduction to standard statistical software for analysing time-to-event data; Survival curves: Lifetables, Kaplain-Meier curves, Why linear or logistic curves won't work; Comparison of survival curves: Log-rank test-Use and assumptions; Design issues in time-to-event data: Designing time to event studies, Choice of end-point; Sample size calculation; Parametric survival modelling; Types of models: Exponential, Weibull, Lognormal and loglogistic models; Testing parameters: likelihood ratio test, Wald test and Akaike Information criteria; Cox's Regression models; Proportional hazard models, Hazard ratios, risk and survival times, Hypothesis test and confidence intervals, Binary and Continuous predictors, Interaction/confounding/Mediation, Adjusting survival curves for comparison.

STS3810 RESEARCH PROJECT

NQF Level: 8
NQF Credits: 32
Course assessment: **100%** (Oral presentation **20%** and Project report **80%** (Internal assessment **40%** and External assessment **40%**))
Pre-requisite: Registered as a fourth year students and STS3732
Contact hour: 2 lectures per week/two semesters
Course Description::A final year project on a selected topic demonstrating the applications of relevant statistical methods culminating in a project report. The course runs throughout the two semesters. Students work under supervision of a member of the academic staff of the department. When possible students may be attached to relevant industries/institutions and so on.

STS3812 MULTIVARIATE DISTRIBUTION THEORY

NQF Level: 8
Notional Hours: 160
NQF Credits 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Pre-requisite: STS3692 and STS3771
Contact hour: 4 lectures plus 1 hour tutorial per week/one semester
Course Description: Basic matrix theory: Basic concepts of matrix theory such as their operations, rank and inverse, special matrices and their properties; Multivariate Normal Distribution: Definition and properties of multivariate normal Distribution, Moment-generating function of multivariate normal variate; Moments: population mean vector and covariance matrix; Marginal and conditional distribution in multivariate context, Quadratic forms in relation to chi-square distribution; Transformations: Random VectorsEstimation of the population and covariance matrix; Inference about the mean vectors: one or two samples cases:

Hotelling's - statistic and tests on the mean vector if the covariance matrix is unknown, Test on the mean difference between two means from independent multivariate normal distributions when the covariance matrix is known (i.e. Chi-square statistic) and it

is unknown (i.e. -statistic); Correlation: Estimation of population mean vector and correlation matrix, Distribution andtests associated with the Pearson correlation coefficient.

STS3872 TIME SERIES ANALYSIS AND FORECASTING

NQF Level: 8
Notional Hours: 160
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Pre-requisite: STS3772
Contact hour: 4 lectures plus 3 hour practical per week/one semester
Course Description: Components of time series: Long-term trend, Seasonal variations, Cyclical variations, Irregular variations; Time series Models: Multiplicative models, Additive models; Trend Analysis: Method of least squares, Method of moving average; Measuring seasonal effect: Specific seasonal indices, Typical seasonal indices; Measuring cyclical effects: Residual method; Smoothing techniques; The Forecasting Context: Basic Forecasting Tools, Time Series Decomposition, Exponential Smoothing Methods, Simple Regression, Multiple Regression, The Box-Jenkins Methodology for ARIMA Models; Advanced Forecasting Models: Regression with ARIMA Errors, Dynamic Regression Models, Intervention Analysis, State Space Models, Neural Networks, Forecasting the Long-term, Mega trends, Analogies, Scenarios, Judgmental Forecasting and Adjustments, Accuracy of Judgmental Forecasts; Judgmental Biases and their Limitations; Combining Statistical and Judgmental Forecasts; Using Forecasting Methods in Practice; Implementing Forecasting: uses, advantages, and Limitations.

STS3832 STATISTICAL QUALITY CONTROL

NQF Level: 8
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Pre-requisite: STS3692 and STS3771
Contact hour: 4 lectures plus 3 hour practicall per week/one semester
Course Description: Quality improvement in modern Business: Dimensions of quality, Quality philosophy and management strategies: Total quality, Quality standards and Registrations, Six sigma; Statistical Methods used in Quality improvements: Describing variation, Important distribution of note, Inference about Process Quality; Methods and philosophy of Statistical Process Control: Chance and assignable cause of Quality variation, statistical basis of control charts: sample size and sampling, rational subgroups, analysis and patterns on control charts, rules for control charts; Control charts for variables: Simple control charts for variables, charts for individual measurements, Operating characteristic functions, application; Control charts for attributes: Properties of charts, charts for fraction nonconforming, charts for nonconformities (defects), choice between attributes and variable control charts; Process and measurement system capability analysis: Process capability ratios, Process capability using a control chart, Gage and measurement system capability studies, setting specification limits, estimating natural tolerance limits of a process; Cumulative sum and exponentially weighted moving average control charts: Principle of Cusum charts, EWMA charts.

POP3892 INDIRECT ESTIMATION

NQF Level: 8
Notional Hours: 160
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3 hour Examination paper).
Prerequisite: POP3731 and POP3732
Contact hour: 4 lectures plus 3 hour practical per week/one semester

Course Description: Definition of indirect techniques in demographic estimation, Need for indirect estimation; Demographic Models: Estimation of fertility based on information on children ever born; Estimation of adult survivorship probabilities from information on orphanhood and widowhood; Estimation of child mortality from information on children ever born and children surviving.

SOS3860 SOCIOLOGY OF GENDER AND SEXUALITY

NQF Level: 8
NQF Credits: 16
Course assessment: Continuous assessment (at least two test and two assignments) **60%**; Examination **40%** (1x3hour Examination paper).
Prerequisite: Admission to the fourth year level
Contact hour: 4 lectures per week/one semester

Course Description: Testing sociological theories of structuralist orientation and of agency, the course will exemplify both approaches: the ways in which societies socialize individuals into gendered identities and roles and the ways in which individuals appropriate and re-construct them; Sociological schools in the conceptualization of gender, i.e. origins of biological sex, origins and strands of feminism; Feminist analysis of Namibian society, women's movement in Namibia; Sexuality i.e. sexual identities, sexual cultures, sexual rights, friendship and intimate relationship; Reproductive health and HIV/AIDS, safe motherhood, contraception, abortion; Concepts of masculinity, construction of masculinities in Namibian society, masculinity and gender-based violence; Gender policies and developmental organizations in Namibia, i.e. Women in Development (WID), Women and development (WAD), Gender and Development (GAD), policy approaches of state and civil society; Gender and economy, i.e. poverty, empowerment, labour market and work place, gender division of labour, job and salary discrimination; Gender and culture, i.e. education, media, cultural traditions and commodified culture; Gender and social culture, i.e. gender stratification, gender and class; Gender and politics, i.e. women and power, women in politics, the legal framework for the promotion of gender equality.

POP3831 MONITORING AND EVALUATION TECHNIQUES

NQF Level 8
NQF Credits 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Prerequisite None
Contact hour: 4 lectures per week/one semester

Course Description: Definitions and Concepts: Monitoring, evaluation; Types and Methods; Familiarizes students in different types of program evaluation, including needs assessment, formative research, process evaluation, monitoring of outputs and outcomes, impact assessment, and cost analysis; Students gain practical experience through a series of exercises involving the design of a conceptual framework, development of indicators, analysis of computerized service statistics, and development of an evaluation plan to measure impact; Covers experimental, quasi-experimental, and non-experimental study designs, including the strengths and limitations of each.

POP3852 POPULATION PROJECTIONS

NQF Level 8
NQF Credits 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Prerequisite POP3732
Contact hour: 4 lecture per week/one semester

Course Description: Introducing population projection, the need for population forecast, Basic methods of population projection and applications, the mathematical method, the limitations of the mathematical method; The component method of population projection: the principles of the method, the details of the method, the use of broader age groups, data requirements; Population projections in the Namibian context.

POP3810 RESEARCH PROJECT

NQF Level: 8
NQF Credits: 32
Course assessment: Continuous assessment **100%** (Oral presentation **20%** and Project report **80%** (Internal assessment **40%** and External assessment **40%**))
Prerequisite: Registered as a fourth year students and POP3731
Compulsory/Elective Compulsory
Contact hour: 2 lectures per week/two semesters

Course Description: A final year project on a selected topic demonstrating the applications of relevant demographic and statistical methods culminating in a project report. The course runs throughout the two semesters. Students work under supervision of a member of the academic staff of the department. When possible students may be attached to relevant industries/institutions etc.

POP3880 RESEARCH METHODOLOGY AND PROJECT

NQF Level: 8
NQF Credits: 38
Course assessment: Continuous assessment **100%** (Oral presentation **20%** and Project report **80%** (Internal assessment **40%** and External assessment **40%**))
Prerequisite: Registered as a fourth year students
Compulsory/Elective Compulsory
Contact hour: 2 lectures per week/two semesters

Course Description: **Research Methodology**: Planning and Designing a Research Study; General Types of Research Designs and Approaches; Data Collection, Assessment Methods, and Measurement Strategies; Data Preparation, Analyses, and Interpretation; Ethical Considerations in Research; Disseminating Research Results and Distilling Principles of Research Design and Methodology.
Research Project: A final year project on a selected topic demonstrating the applications of relevant demographic and statistical methods culminating in a project report. The module runs throughout the two semesters. Students work under supervision of a member of the academic staff of the department. When possible students may be attached to relevant industries/institutions etc.

POP3872 POPULATION MIGRATION AND URBANIZATION

NQF Level 8
NQF Credits 16
Course assessment: Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x3hour Examination paper).
Prerequisite POP3732
Compulsory/Elective Compulsory
Contact Hours 4 lectures per week/one semester

Course Description: Definition and terminologies in migration studies; International migration: Sources of data, quality of statistics; Evaluation and estimation of international migration; Intercensal component method; Intercensal cohort – component method; Net migration, gross migration (migration turnover) and migration ratios; Migration rates: crude immigration rate, Crude emigration rate, Crude net migration rate, Crude gross migration rate; Contribution of migration to population change; Graphic techniques of analysis (population turnover); Life-time migration; Migration streams and counter streams; Return migration; Longitudinal migration; Bases of migration rates; Sources of migration statistics; Measurement of mobility; National growth rate method; Residual methods; vital statistics method; Residual method: survival rate method, Place of birth vs place of enumeration statistics, Residence at a fixed past date; Migration selectivity: by sex, by age, by educational level etc. Causes of migration, Ravenstein'spush and pull theory; Lee's Intervening Obstacles theory; Other theories; Other consequences of migration at the place of origin and at the place of destination. Internal migration (Namibian context); Urbanization – Trend: levels and patterns, Modernization theory and urbanization, Linkages between migration and urbanization, Manifestation of urbanization and challenges faced by urban centres due to rapid urbanization.

F.13.6. STATISTICS AND POPULATION STUDIES COURSE EQUIVALENTS

Old Course			New/Revised Course	
1	STS3531	Descriptive Statistics	STS3531	Descriptive Statistics
	STS3532	Introduction to Probability	STS3532	Introduction to Probability
2	STS3631	Statistical Estimation	STS3671	Statistical Methods
	STS3612	Introduction to Statistical Computing	STS3652	Fundamentals of Statistical Computing
		No Equivalence- New Module	STS3692	Distribution Theory
	STS3632	Statistical Inference		No Equivalents, module will be offered
3	STS3711	Linear Models	STS3772	Linear Models
	STS3721	Distribution Theory		No Equivalents, module will be offered
	STS3731	Sampling Techniques	STS3731	Sampling Techniques
	STS3732	Data Processing	STS3732	Data Processing
	STS3752	Experimental Design and Analysis of Variance	STS3752	Experimental Design and Analysis of Variance
	STS3701	Research and Survey Methods	STS3702	Research and Survey Methods
	STS3712	Non-Parametric and Categorical Statistics	STS3741	Non-Parametric and Categorical Statistics
4		No Equivalence- New Module	STS3871	Survival Analysis
		No Equivalence- New Module	STS3851	Operational Research
	STS3821	Decision Analysis		No Equivalents, will be offered
	STS3831	Stochastic Processes	STS3831	Stochastic Processes
	STS3811	Statistical Computer Programming		No Equivalents, will be offered
	STS3812	Multivariate Distribution Theory	STS3812	Multivariate Distribution Theory
	STS3810	Research Project	STS3810	Research Project
	STS3801	Time Series		No equivalents, module will be offered
	STS3852	Forecasting Methods and Applications		No Equivalents, module will be offered
		No Equivalence- New Module	STS3872	Time Series and Forecasting
	STS3832	Statistical Quality Control	STS3832	Statistical Quality Control
1		No Equivalence- New Module	POP3512	Fundamentals of Population Theory
	POP3631	Official Statistics and National Statistical Systems	POP3631	Official Statistics and National Statistical Systems
	POP3611	Introduction to Demography	POP3611	Introduction to Demography
		No Equivalence- New Module	POP3612	Epidemiological Methods
		No Equivalence- New Module	POP3632	Fundamentals of Population and Development
3	POP3711	Demographic Methods I	POP3711	Demographic Methods I
	POP3731	Fundamentals of Data Processing	POP3731	Fundamentals of Data Processing
	POP3732	Demographic Methods II	POP3732	Demographic Methods II
4		No Equivalence- New Module	POP3831	Monitoring and Evaluation
	POP3811	Epidemiological Methods		No equivalents, will be offered
	POP3832	Population Migration	POP3832	Population Migration
	POP3822	Population Projections	POP3822	Population Projections
	POP3810	Research Project	POP3810	Research Project
		No Equivalence- New Module	POP3892	Indirect Estimation

F.13.7. SERVICE COURSES

STS 3522 INTRODUCTION TO STATISTICS

NQF Level:	5
Notional Hours:	80
NQF Credits:	8
Course assessment:	Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x2hour Examination paper).
Pre-requisite:	Faculty entry requirements
Compulsory/Elective	Compulsory
Contact hour:	2 lectures plus 1 hour tutorial per week/one semester

Course Description: Terminologies used in statistics; Populations and samples as sources of data; The need for sampling; Probability and non-probability sampling techniques; Summarising data using frequency distributions and graphs; Computation of descriptive statistics for ungrouped and grouped data; Use of the scientific calculator.

STS 3621 STATISTICS FOR LIFE SCIENCE

NQF Level:	6
Notional Hours:	80
NQF Credits:	8
Course assessment:	Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x2hour Examination paper).
Pre-requisite:	STS 3522
Compulsory/Elective:	Compulsory
Contact hour:	2 lectures plus 1 hour tutorial per week/one semester

Course Description: Tests of Hypotheses: one sample and two sample cases for dependent and independent samples; Confidence Intervals. Linear regression and correlation.Test of Significance of regression and Correlation coefficients; Predictions using regression models.

STS 3622 STATISTICS FOR LIFE SCIENCE II

NQF Level:	6
Notional Hours:	80
NQF Credits:	8
Course assessment:	Continuous assessment (at least two test and two assignments) **40%**; Examination **60%** (1x2hour Examination paper).
Pre-requisite :	STS 3522
Compulsory/Elective:	Compulsory
Contact hour:	2 lectures plus 1 hour tutorial per week/one semester

Course Description: Design of Biological Experiments: Choice of factors, sampling units, Analysis of variance: One- and two-way. Selecting samples, replications. Nonparametric tests: Sign test, Mann- Whitney U- test, Wilcoxon- Signed Ranks test, Spearman rank correlation test, Kruskal – Wallis H – test, Friedman's test; Use of Chi- square test for independence and goodness of fit. Tests for normality should be included Shannon-Wiener index.

F.14. MSC APPLIED STATISTICS AND DEMOGRAPHY (11MSST)

F.14.1. DEPARTMENTAL REGULATIONS

F.14.1.1. ADMISSION REQUIREMENTS

The MSc Programme in Applied Statistics and Demography will require a minimum of a BSc, with a Statistics or Population Studies Major, in the lower second class division (60-69%) or an equivalent qualification.

F.14.1.2. DURATION OF STUDY

The Master of Science in Applied Statistics and Demography cannot be completed in less than two (2) years. The programme must be completed within three (3) years of full-time study.

F.14.1.3. CURRICULUM COMPILATION

The curriculum for the MSc Applied Statistics and Demography consists of coursework and the writing of a research thesis. Refer to the Regulations for Postgraduate Courses of study in the General Prospectus: Information, Regulations & Fees.

FIRST YEAR COURSES

First Semester
UAE5819 Advanced Academic Writing for Post Graduate Studies
STM5911 Research Design and Methodology
STM5921 Population and Development
STM5951 Statistical Computing

Second Semester
STM5912 Generalized Linear models
STM5932 Multivariate Data Analysis
STM5922 Monitoring and Evaluation
STM5952 Demographic Analysis

SECOND YEAR COURSES
STM5900 MSc Thesis

F.14.1.4. EXAMINATION REGULATIONS

If a student fails, the first semester course he/she may proceed to the next semester. However, he/she must repeat the course in the following year. A minimum of 50% is required to pass each course.

F.14.1.5. PRACTICALS

All practicals are compulsory.

F.14.1.6. COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

QUALIFICATION: MSc Applied Statistics and Demography (11MSST)

YEAR 1

CODE	COURSE NAME	NQF LEVEL	CREDIT	PRE-REQUISITES	CO-REQUISITES
UAE5819	Advanced Academic Writing for Postgraduate Studies		NCB		None
STS5921	Research Design and Methodology		12		None
STM5921	Population and Development		12		None
STM5951	Statistical Computing		24		None
STS5931	Linear and Generalized Linear models		24		None
STM5952	Demographic Analysis		24		None
	ELECTIVES (CHOOSE ANY TWO)				
STM5932	Multivariate Data Analysis		24		None
STS5972	Statistical Tools for Programme Evaluation		24		None
STM5972	Analysis of Dependent Data		24	STS5931	None
STM5952	Advanced Demographic Methods		24	STS5931, STM5952	
Total Credits			**180**		

YEAR 2

SEMESTER	COURSE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1 & 2	MSc Thesis	STM5900	120	Passed all first year courses	None

Total Credits	120	

FIRST YEAR COURSES

FIRST SEMESTER

UAE5819 ADVANCED ACADEMIC WRITING FOR POST GRADUATE STUDIES

Course Title: **ADVANCED ACADEMIC WRITING FOR POST GRADUATE STUDIES**
Code: **UAE5819**
NQF Level: 9
Contact hours: 4 lecture periods per week and 1 practical session per week for one semester
Credits: 24
Course Assessment: CA: (1 x 3 hour exam paper)
Prerequisites: Must be a postgraduate student.
Content: This course is a post-graduate course designed to empower students with skills and knowledge to access and critique academic sources and to synthesize information from these sources to assist them in the substantiation and development of their own claims when writing an academic paper in their respective fields of specialization. Additionally, this course will empower students with the capacity to undertake the challenges of academic writing by exposing them to the different rhetorical and stylistic elements typical of academic texts. Finally, students will be introduced to the American Psychological Association (APA) writing style and will be equipped with the necessary skills to format an academic paper in APA style.

STM5911 RESEARCH DESIGN AND METHODOLOGY

Course title: **RESEARCH DESIGN AND METHODOLOGY**
Course Code: **STM5911**
NQF Level: 9
Contact hours: 4 lectures per week for one semester
NQF Credits: 24
Course Assessment: Continuous assessment **(50%);** 1x3 hour examination paper **(50%)**
Pre-requisites: Admission Requirements
Content: Types of research; Formulation of a research problem: identification of researchable topics, formulation of objectives, problem statement, research questions, hypotheses etc; Literature review: citation and referencing, plagiarism, Research designs: Sample Surveys, Censuses, Experiments, desk review, etc Research methodology: target population, units of enquiry, sampling designs, data source and collection methods, measurement instruments, questionnaire design principles, piloting research tool, field administration, Data management (Understanding and measuring survey quality (process quality and outcome quality; data quality; total survey error and classification of sources of errors; reliability and validity); Data analysis methods; Ethical considerations; Developing a research proposal; Report writing: structure, language, presentation of figures and tables, interpretation of results; Writing courses: Microsoft Word, Latex, etc; Appropriate communication skills: design of presentation materials, presentation skills.

STM 5921 POPULATION AND DEVELOPMENT

Course title: **POPULATION AND DEVELOPMENT**
Course Code: **STM5921**
NQF Level: 9
Contact hours: 2 lectures per week for one semester
NQF Credits: 12
Course Assessment: Continuous assessment **(50%);** 1x2 hour examination paper **(50%)**
Prerequisites: Admission Requirements
Content: Population trends: world trend, levels and differentials; implication of fertility and mortality; the role of migrationin world population trends; demographic-economic interrelationship; the world population "explosion" "momentum"; marriage trends and the birth rate contemporary marriage trends in the West. Determinants and consequences of population trends; Causes and consequences of world demographic change. Population Policies and Development: development theory and policy, relationships between economic and demographic growth, effectiveness of population policies; Sexual and reproductive health programmes and policies; the 1965, 1969, 1974, 1984, and 1994 World Population Conferences. HIV epidemic in Africa and its impact on populations., the socio-economic consequences of HIV/AIDS; migration and urbanization; Demographic inputs for development: Integration of demographic variables into sectoral and regional/local planning, Design and evaluation of population projects and programs with emphasis on decentralization

STM5951 STATISTICAL COMPUTING

Course title: **STATISTICAL COMPUTING**
Course Code: **STM5951**
NQF Level: 9
Contact hours: 4 lab based lectures per week for one semester
NQF Credits: 24
Course Assessment: Continuous assessment **(50%);** 1x3 hour examination paper **(50%)**
Pre-requisites: None
Content: Introduction to statistical and demographic software; Data entry (Database creation, variable definition, etc); Manipulation and management of data; Summarizing data numerically and graphically; Statistical procedures including formal tests of hypotheses of interest

SECOND SEMESTER

STM5952 DEMOGRAPHIC ANALYSIS

Course title: **DEMOGRAPHIC ANALYSIS**
Course Code: **STM5952**
NQF Level: 9
Contact hours: 4 lectures per week for one semester
NQF Credits: 24
Course Assessment: Continuous assessment **(50%);** 1x3 hour examination paper **(50%)**
Prerequisites: Departmental Entry Requirements
Content: Demographic Analysis: Fertility analysis, Nuptiality, Morbidity, Mortality analysis, Internal and international migration analysis, Geographical distribution of population, urbanization, Evaluation of demographic data, Population structure and dynamics and its economic and social determinants and consequences. The Life table; Population estimates and projections Approaches to measuring maternal mortality: Civil registration systems; Sisterhood methods, Orphanhood method

STM5912 GENERALISED LINEAR MODELS

Course title: **GENERALIZED LINEAR MODELS**
Course Code: **STM5912**
NQF Level: 9
Contact hours: 4 lectures per week for one semester
NQF Credits: 24
Course Assessment: Continuous assessment **(50%)**; 1x3 hour examination paper **(50%)**
Prerequisites: Departmental Entry Requirements
Content: Principles of model fitting; Exponential family of distributions; Generalized Linear Models: Estimation and inference with Normal, Binomial and Poisson error distributions; Binary responses and Logistic regression (odds ratios); Contingency tables (Relative risk, Goodness of fit) and Log-linear models; Residual analysis and diagnostic measures. Multilevel models

STM5932 MULTIVARIATE DATA ANALYSIS

Course title: **MULTIVARIATE DATA ANALYSIS**
Course Code: **STM5932**
NQF Level: 9
Contact hours: 4 lectures per week for one semester
NQF Credits: 24
Course Assessment: Continuous assessment **(50%)**; 1x3 hour examination paper **(50%)**
Prerequisites: Departmental Entry Requirements
Content: Applications of Discriminant analysis, Principal Component analysis, Factor analysis
Cluster Analysis; MANOVA, Canonical Correlation; Interpretation of results from statistical analyses; Imputation of missing data.

STM5922 MONITORING AND EVALUATION

Course title: **MONITORING AND EVALUATION**
Course Code: **STM5922**
NQF Level: 9
NQF Credits: 12
Contact hours: 2 lectures per week for one semester
Course Assessment: Continuous assessment **(50%);** 1x2 hour examination paper **(50%)**
Prerequisites: Departmental Entry Requirements
Content: The importance of monitoring as a management tool; Comparison between Monitoring and Evaluation; key uses of M&E information; The role of government departments in promoting useful M&E systems; Steps to Developing an M&E System; Integration of population variables in development planning; Evaluation methods of programmes; Monitoring techniques of programmes; Operational research; Assessing Data Quality: Primary and Secondary Statistical Data; Defining evaluation questions; Data collection; indicator development.

STM5900 THESIS

Course title: **THESIS**
Course Code: **STM5900**
NQF Level: 9
NQF Credits: 120
Pre-requisites: All first year courses
Course Assessment: **100%** Thesis
Content: A student will be expected to choose a topic under the guidance of a supervisor and undertake research. Students will be expected to demonstrate key research steps including information gathering, analysis and interpretation. They will be expected to demonstrate statistical and demographic techniques to a real research problem.

F.15. MSC BIOSTATISTICS (11MSSB)

F.15.1. DEPARTMENTAL REGULATIONS

F.15.1.1. ADMISSION REQUIREMENTS

The minimum entry requirement for MSc Biostatistics of study is a BSc Statistics Honours or equivalent NQF Level 8 qualification from a recognized institution, with overall grade of at least 60%.
Candidates with BSc Population Studies (Hons) will be required to pass the following undergraduate Statistics modules with at least a 60% average before applying for the MSc Biostatistics. Required modules are: STS3672-Distribution Theory; STS3771-Statistical Inference; STS3812-Multivariate Distribution Theory; STS3831-Stochastic Processes.

F.15.1.2. DURATION OF STUDY

The Master of Science in Biostatistics cannot be completed in less than two (2) years. The programme must be completed within three (3) years of full-time study.

F.15.1.3. CURRICULUM COMPILATION

The curriculum for the MSc Biostatistics consists of coursework and the writing of a research thesis. Refer to the Regulations for Postgraduate Courses of study in the General Prospectus: Information, Regulations & Fees.

FIRST YEAR COURSES

First Semester
STS5921 Research Design and Methodology
STS5931 Linear and Generalised Linear Models
STS5951 Statistical Theory
STS5961 Epidemiology

Second Semester
UAE5819 Advanced Academic Writing for Post Graduate Studies
STS5982 Longitudinal Data Analysis
STS5992 Clinical Trials Design and Sampling
STS5942 Modelling Survival Data

SECOND YEAR COURSES
STM5980 MSc Thesis

F.15.1.4. EXAMINATION REGULATIONS

If a student fails the first semester course he/she may proceed to the next semester. However he/she must repeat the course in the following year. A minimum of 50% is required to pass each course. A Thesis will commence only if 80% of all first year modules are passed (equivalent to 96 credits) and must include a pass in STS 5921-Research Methodology.

F.15.1.5. PRACTICALS

All practicals are compulsory.

F.15.1.6. COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

QUALIFICATION: MSc Biostatistics (11MSSB)

YEAR 1

CODE	COURSE NAME	NQF LEVEL	CREDIT	PRE-REQUISITES	CO-REQUISITES
STS5921	Research Design and Methodology	**8**	12		None
STS5931	Linear and Generalised Linear Models	**8**	24		None
STS5951	Statistical Theory	**8**	24		None
STS5961	Epidemiology	**8**	12		None
UAE5819	Advanced Academic Writing for Post Graduate Studies	**8**	NCB		None
STS5982	Longitudinal Data Analysis	**8**	18		None
STM5992	Clinical Trials Design and Sampling	**8**	18		None
STM5942	Modelling Survival Data	**8**	12		None
Total Credits			**120**		

YEAR 2

SEMESTER	COURSE NAME	CODE	CREDIT	PRE-REQUISITES	CO-REQUISITES
1 & 2	MSc Thesis	STM5980	120	Passed 80% all first year courses	None

Total Credits	**120**	

FIRST YEAR COURSES

FIRST SEMESTER

UAE5819	**ACADEMIC WRITING FOR POSTGRADUATE STUDENTS**
Course Title:	ACADEMIC WRITING FOR POSTGRADUATE STUDENTS
Code:	UAE5819
NQF Level:	8
Contact hours:	70 hours (4 lecture periods per week and 1 practical session per week for one semester)
Credits:	24
Course Assessment:	CA: (1 x 3 hour exam paper)
Prerequisites:	Must be a postgraduate student.

Course description: This course is a post-graduate course designed to empower students with skills and knowledge to access and critique academic sources and to synthesize information from these sources to assist them in the substantiation and development of their own claims when writing an academic paper in their respective fields of specialization. Additionally, this course will empower students with the capacity to undertake the challenges of academic writing by exposing them to the different rhetorical and stylistic elements typical of academic texts. Finally, students will be introduced to the American Psychological Association (APA) writing style and will be equipped with the necessary skills to format an academic paper in APA style.

STS5921	**RESEARCH METHODOLOGY**
Course Title:	RESEARCH METHODOLOGY
Code:	STS5921
NQF Level:	9
Contact Hours:	42 hours (2 lecture periods per week and 1 practical session per week for one semester)
Credits:	12
Course Assessment:	CA: 50% (40% from at least 2 tests and seminar presentation 10%), Exam 50% (3 hours exampaper)
Prerequisites:	None

Course description: The module aims to introduce students to methods that to scientific and administrative structure that supports investigators from diverse backgrounds and to have skills that will allow them provide high-quality consultation in research design and biostatistical analysis. **Study Design and Proposal Development**: Choosing a research topic; Formulating study aims and objectives; Formulate wording of testable hypotheses and associated primary aims; Suggest an optimal study design; Search and evaluate related published literature on planned measures for adequate evidence of reliability and validity; Determine the needed sample size or estimated power and write this up; Write the statistical analysis plan for the protocol; Respond to relevant parts of a critique by reviewers of the protocol; **Implementation and Study Conduct**: Review proposed data collection instruments and other measures for reliability, validity, and suitability for the planned data analysis; Establish coding rules with data entry staff, such as handling of missing data and invalid responses on questionnaires; Respond to questions about methodology, including protocol irregularities and changes; **Data Management and Data analysis**: Identifying and setting up appropriate systems for research data management; Audit data for completeness and validity; Plan, direct, interpret, and report any interim analysis, and advise on changes; Plan, direct, interpret, and report the final data analysis; Present and explain analytic results to co-investigators and project team; **Presentation/Publication**: Design and direct preparation of tables and publication graphs; Core issues in scientific writing: collaborate in writing papers, abstracts, presentations; Review data accuracy and interpretation of inferential statistics in all reports of study methods and results; Respond to journal referees with written comments and/or additional analyses or data.

STS5951	**STATISTICAL THEORY**
Course Title:	**STATISTICAL THEORY**
Code:	STS5951
NQF Level:	9
Contact Hours:	42 hours (2 lecture periods per week and 1 practical session per week for one semester)
Credits:	24
Course Assessment:	CA: 50% (40% from at least 2 tests and seminar presentation 10%), Exam 50% (3 hours exam paper)
Prerequisites:	None

Course description: Point and Interval Estimation: Maximum Likelihood Estimators: Method of Moments Estimators; MSE and Bias; Exponential Families, UMVUEs, and the FCRLB; Confidence Regions Sufficient Statistics: Statistics and Sampling Distributions; Minimal Sufficient Statistics; Testing Statistical Hypotheses: Hypothesis Tests and Power; Exponential Families, the Neyman-Pearson Lemma, and UMP Tests; Likelihood Ratio Tests; Bayesian Inference: Bayes Estimators; Credible Intervals; Conjugate Priors; Noninformative Priors; Hierarchical Bayes and Empirical Bayes; Multiparameters models, normal with unknown mean and variance, the multivariate normal distribution, multinomial models; Posterior simulation and integration; Markov Chain Simulation; Large Sample Theory: Types of Stochastic Convergence; Tools for Proving Large Sample Results; Asymptotic Normality of Maximum Likelihood Estimators; Model Selection: Likelihood-Based Model Selection; Bayesian Model Selection; Prediction: Plug-in prediction; Likelihood prediction; Bayesian prediction; Assessment of predictions.

STS 5931	**LINEAR AND GENERALIZED LINEAR MODELS**
Course Title:	**LINEAR AND GENERALIZED LINEAR MODELS**
Code:	STS5931
NQF Level:	9
Contact Hours:	42 hours (2 lecture periods per week and 1 practical session per week for one semester)
Credits:	24
Course Assessment:	CA: 50% (40% from at least 2 tests and seminar presentation 10%), Exam 50% (3 hours exam paper)
Prerequisites:	None

Course description: Exponential family of distributions; Generalized Linear Models: Model Fitting and Inference; Binary Logistic regression; Regression models for nominal and ordinal outcomes; Regression with count outcomes; Regression for time series; Doubly Bounded Continuous Variables: Zero- and One-Inflated Models; Finite Mixture Models; Models for Censored and Truncated Variables.

STS5961	EPIDEMIOLOGY
Course Title:	**EPIDEMIOLOGY**
Code:	STS5961
NQF Level:	9
Contact Hours:	42 hours (4 lecture periods per week and 1 practical session per week for one semester)
Credits:	12
Course Assessment:	CA: 50% (40% from at least 2 tests and seminar presentation 10%), Exam 50% (3 hours exam paper)
Prerequisites:	Admission Requirements

Course description: Fundamental issues: Measuring disease; Measuring the risk factor; Causality: Assessing risk factors: Risk and relative risk; Odds and odds ratio; Relative risk or odds ratio; Prevalence studies; Testing association; Risk factors measured at several levels; Attributable risk; Rate and relative rate; Measures of difference; Confounding and interaction: The concept of confounding; Identification of confounders; Assessing confounding; Standardisation; Mantel–Haenszel methods; The concept of interaction; Dealing with interaction; Study designs: Ecological design; Cross-section; Case-control; Cohort Studies and Intervention Studies; Meta-analysis: Reviewing evidence; Systematic review; A general approach to pooling; Investigating heterogeneity; Pooling tabular data; Individual participant data; Dealing with aspects of study quality; Publication bias; Advantages and limitations of meta-analysis; Risk scores and clinical decision rules: Association and prognosis ; Risk scores from statistical models; Quantifying discrimination ; Calibration; Recalibration; The accuracy of predictions; Assessing an extraneous prognostic variable; Reclassification; Validation; Presentation of risk scores.

SECOND SEMESTER

STS5982	LONGITUDINAL DATA ANALYSIS
Course Title:	**LONGITUDINAL DATA ANALYSIS**
Code:	**STS5982**
NQF Level:	9
Contact Hours:	42 hours (2 lecture periods per week and 1 practical session per week for one semester)
Credits:	18
Course Assessment:	CA: 50% (40% from at least 2 tests and seminar presentation 10%), Exam 50% (3 hours exam paper)
Prerequisites:	None

Course description: Nature of longitudinal studies, Advantages of Longitudinal Studies; Challenges of Longitudinal Data Analysis; Some General Notation; Data Layout; ANOVA Approaches to Longitudinal Data: Single-Sample Repeated Measures ANOVA; Multiple-Sample Repeated Measures ANOVA; MANOVA Approaches to Longitudinal Data: MANOVA for Repeated Measurements; Mixed-Effects Regression Models for Continuous Outcomes: Random Intercept; Random Slope and Trend; Mixed-Effects Polynomial Regression Models: Curvilinear Trend Model; Orthogonal Polynomials; Covariance Pattern Models: Covariance Pattern Models; Model Selection; Mixed Regression Models with auto-correlated errors; Generalized Estimating Equations (GEE) Models; Mixed-Effects Regression Models for Binary Outcomes; Mixed-Effects Regression Models for Ordinal Outcomes; Mixed-Effects Regression Models for Nominal Data; Mixed-effects Regression Models for Counts; Mixed-Effects Regression Models for Three-Level Data; Missing Data in Longitudinal Studies.

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STS5992	CLINICAL TRIAL DESIGNS AND SAMPLING
Course Title:	**CLINICAL TRIAL DESIGNS AND SAMPLING**
CODE:	**STS5992**
NQF Level:	9
Contact Hours:	42 hours (2 lecture periods per week and 1 practical session per week for one semester)
Credits:	18
Course Assessment:	CA: 50% (40% from at least 2 tests and seminar presentation 10%), Exam 50% (3 hours exam paper)
Prerequisites:	None

Course description: Concepts and designs of clinical trials: controlled and uncontrolled clinical trials; historical controls; protocol; placebo; randomisation; blind and double blind trials; ethical issues; protocol deviations; Size of trials considerations: Study Design, Hypothesis Testing, Primary Study End Point, Expected Response Test vs. Control, Clinical Important/Meaningful Difference/Margin, Level of Significance, Power, Drop-out rate, Unequal Treatment Allocation; Multiplicity and meta-analysis: interim analyses; multi-centre trials; combining trials; Cross-over trials; Survey Methodology: Classification of Surveys, Total Survey Error Common Survey Sampling Techniques, Frames, Framing Effects, and Survey Responses; Complex survey sampling: stratification, clustering, weighting, multistage/multiphase sampling; Regression models for survey data: Complexity of modelling survey data; Multistage, Multiphase, and Repetitive Sampling: case-control sampling, case-cohort sampling; Sampling from Inadequate Frames: Domain Estimation, Post-stratification, Estimation from Multiple Frames, Small Area Estimation; Incomplete Data: Non-sampling Errors, Nonresponse, Callbacks Weight Adjustments, Use of Super-population Models, Adaptive Sampling and Network Sampling, Imputation, Unmatched, matched, and counter-matched case-control designs.

G. DEPARTMENT OF GEOLOGY

Geology is the science about our planet Earth; it involves the analysis of the Earth's structure, composition, and its evolution through Earth History. Geology is a science under the umbrella of Geosciences; it is a relevant discipline in the understanding of Earth Materials and Earth Processes. These encompass natural resources including ores, energy resources such as hydrocarbons, building material, and water.

Geology extends into environmental science as far as the pollution of our environment, in particular that of soils and groundwater is concerned. In addition geology is linked with engineering, as construction on and within the ground needs to consider the mechanics of bedrocks and soils. Geohazards, in particular landslides, earthquakes and volcanic eruptions, form another discipline under the umbrella of geosciences.

Geology is a professional career, where graduates become members of the professional organizations in the countries that they will be employed. As such the standard of the graduands are expected to meet the high standards in industry. This requires that students acquire a sound background in natural sciences, in particular chemistry, physics and mathematics, but do also participate in field trips. Practical competences will be learned and sharpened in the field. These practical competences of the graduands are highly valued, and therefore we expect all our students to take a keen interest in the field trip aspect of the geology curricula.

The field work activity varies from 1-3 day trips to 1-4 weeks during semester breaks and at the end of the year. Students should note that field trips are physically strenuous and all students participating in field trips are therefore required to be medically fit for outdoor activities. In addition students will be required to purchase certain items essential for field work and outdoor activities in remote areas.

The department of geology offers coursework programmes for Bachelor of Science Geology Honours, Master of Science in Applied Geology (with Major in Exploration & Economic Geology, or Major in Environmental Geology & Hydrogeology), and Master of Sciene in Petroleum Geology.

The BSc Geology Honours qualification is a comprehensive geoscience degree that allows graduates to enter a professional career. The Master of Science qualifications are more advanced and specialized in the respective fields of the curricula.

In addition to the taught BSc and MSc programmes the geology department offers MSc and PhD degrees by research (thesis only).

G.1. BSC GEOLOGY HONOURS 11BSCG

G.1.1. REGULATIONS

G.1.1.1. Admission Requirements

To register in the BSc Geology Honours Degree, a candidate must hold a valid NSSC-O or NSSC-A certificate or equivalent with passes in at least five subjects which add up to **25 points**, calculated using the UNAM specified scale. In addition to the above requirements, the candidate must have at least a **'C' symbol in English**, a **'C' symbol in Physical Sciences** and a **'C' symbol in Mathematics** on NSSC or equivalent qualification. **First year students are required to pass a departmental selection test before admission** to the BSc Geology Honours program.

Mature age entrants will gain admission as per UNAM mature age entry regulations contained in the General Prospectus: Information, Regulations and Fees.

Field trips to various places of geological interest are an integral part of the geology curriculum and students are therefore required to be **medically fit for outdoor activities**.

G.1.1.2. Minimum Requirements for Re-admission into the Faculty

To be re-admitted to the Faculty of Science for a particular year of registration, a student must have passed the minimum number of courses required as indicated below:

1. 4 courses (equivalent to **64 credits**) by the end of the first year; 2 of these courses (equivalent to 32 credits) be **non-core** (30%)
2. 9 courses (equivalent to **144 credits**) by the end of the second year (45%)
3. 16 courses (equivalent to **256 credits**) by the end of the third year (57%)
4. 24 courses (equivalent to **384 credits**) by the end of the fourth year (69%)

G.1.1.3. Advancement and Progression rules

From Year 1 to Year 2: To progress to the second (2nd) year of study, all first year students registered for the B.Sc. Geology Honours program must pass all the first (1st) year level courses 10+1/2 courses (equivalent to **168 credits**). In exceptional cases, students who have failed first year courses may be allowed by the Department to progress to second year, depending on their overall performance which should be outstanding.

From Year 2 to Year 3: In order to advance to the third (3rd) year level of study, a student must have passed all first year courses and at least 2/3 of the prescribed second year courses, i.e. 6 courses (equivalent to **96 credits**). Furthermore, students may not register for third year level courses without the necessary pre-requisites for such courses.

From Year 3 to Year 4: In order to advance to the fourth (4th) year level of study, a student must have passed all second year courses and at least 2/3 of the prescribed third year courses, i.e. 6 courses (equivalent to **96 credits**). Furthermore, students may not register for fourth year level courses without the necessary pre-requisites for such courses.

G.1.1.4. Assessment

Unless otherwise indicated, assessment is based on a written examination and continuous assessments (CA) with a **60 (exam):40 (CA)** weighting for each course. Continuous assessment is based on tests, assignments, field studies, industrial attachment, laboratory practicals and seminar presentations. The final-year master thesis is based on a research project. A minimum of **50% is required to pass each course** and a student is **required to attend 80% of all lectures and practicals**.

G.1.1.5. Change into the BSc Geology Honours Programme

Only science students who study towards a BSc Physics Honours Degree with Geology Electives or a BSc Chemistry Honours Degree with Geology Electives shall be eligible to change to the BSc Geology Honours Programme subject to the following conditions:

1. Change is only possible directly after the first year of study in the Science Faculty.
2. The candidate must have successfully completed the first year of study by having cleared all 1st year courses within one academic year.
3. The academic record of the first year of study must be outstanding (65% minimum).
4. The availability of space in the B.Sc. Geology Honours program which is limited by the student numbers in the Geology Department.
5. Final approval of the change will be made by the Geology Department.

In 2017 geology minor students or other students who have already enrolled for a degree in the Science and Engineering Faculty will not be allowed to change to the geology program.

G.1.1.6. Graduation

This qualification will be awarded to candidates who have cleared all prescribed courses giving cumulative **544 credits**. This includes passing the compulsory field geology courses and the research project and relevant elective courses. The Geology Department shall recommend all successful candidates who should graduate with a BSc Geology Honours Degree.

G.1.1.6 Curriculum Bachelor of Science in Geology Honours 11BSCG

QUALIFICATION: BSC GEOLOGY HONOURS (11BSCG)

Students opting for BSc Geology Honours must take all of the following courses:

YEAR 1

CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 1 Semester 1					
CLC3509	Computer Literacy	5	8		None
LCE3419	English Communication & Study skills	4	16		LEA3519
CHM3511	Chemistry 1A	5	16		CHM3512
PHY3511	Physics for Physical Sciences I	5	16		PHY3512
GLY3521	Introduction to Physical Geology & Surface Processes	5	8		GLY3502
MAT3511	Basic Mathematics	5	16		
CSI3580	Contemporary Social Issues	**5**	8		
Year 1 Semester 2					
GLY3502	Introduction to Earth Systems	5	8		GLY3521
CHM3512	Chemistry 1B	5	16		CHM3511
PHY3512	Physics for Physical Sciences II	5	16		PHY3511
MAT3512	Pre-Calculus	5	16		MAT3511
LEA3519	English for Academic Purposes	5	16		LCE3419
STS3522	Introduction to Statistics	5	8		None
Total Credits			**168**		

YEAR 2

CODES	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 1 Semester 1					
MAT3611	Calculus I	6	16	MAT3512	None
CHM3611	Inorganic Chemistry I	6	16	CHM3511& CHM3512	None
GLY3621	Introduction to Hydrology	6	8	MAT3512&GLY3521	None
CHM3631	Physical Chemistry I	6	16	CHM3511&CHM3512, MAT3511 & MAT3512	None
Year 2 Semester 2					
MAT3612	Calculus II	6	16	MAT3512	None
GLY3612	Stratigraphy & Geological Mapping	6	16	GLY3521	None
GLY3632	Crystallography & Mineral Chemistry	6	16	MAT3512**&**CHM3512	None
GLY3642	Introduction to Geochemistry	6	8	MAT3512 **&** GLY3521 **&** CHM3512	None
GLY3662	Introductory Petrology	6	8	GLY3521	None
GLY3600	Field Geology I	6	8	GLY3521	None
Total Credits			**128**		

YEAR 3

CODES	COURSE NAME	NQF Level	CREDITS	PRE–REQUISITES	CO-REQUISITES
Year 3 Semester 1					
GLY3741	GIS	7	8	GLY3612	None
GLY3711	Mineralogy	7	16	GLY3632 &CHM3512	None
GLY3721	Plate Tectonics	7	8	GLY3612	None
GLY3751	Sedimentology	7	16	GLY3612 & GLY3662	None
GLY3761	Regional Geology of Namibia	7	8	GLY3521	None
GLE3701	Environmental & Engineering Geology I	7	8	GLY3642 & GLY3621	None
Year 3 Semester 2					
GLY3702	Hydrogeology I	7	8	GLY3621 & GLY3642	None
GLY3712	Structural Geology I	7	16	GLY3612 & MAT3612& GLY3600	None
GLY3732	Igneous & Metamorphic Petrology	7	16	GLY3662 & GLY3642 & GLY3600	None
GLY3762	Research Methodology	7	8	GLY3600	None
GLY3782	Exploration Geochemistry & Geostatistics	7	8	GLY3642	None
GLY3700	Field Geology II	7	8	GLY3600	None
Total Credits		**128**			

YEAR 4

CODE	COURSE NAME	NQF Level	CREDITS	PRE–REQUISITES	CO-REQUISITES
Year 4 Semester 1					
GLE3821* or **GLY3801***	Environmental & Engineering Geology II **or** Industrial Mineral Gemstones	8 **or** 8	8	GLE3701 **or** GLY3711	None
GLY3831	Economic Geology	8	16	GLY3711 & GLY3721	None
GLY3871* or **GLY3811*** or **GLY3812***	**Igneous & Metamorphic Petrogenesis (option 1)** **or** **Coal, Gas & Petroleum (option 2)** **or** **Hydrogeology II (option 3)**	8 **or** 8 **or** 8	16	GLY3732 & GLY3711 **or** GLY3751 **or** GLY3702	None
Year 4 Semester 2					
GLY3832	Exploration Geology and Geophysics	8	16	GLY3712	None
GLY3822	Remote Sensing	8	8	GLY3712	None
GLY3862	Structural Geology II	8	8	GLY3712 & GLY3700	None
GLY3810	Research Project	8	32	All third year courses	GLY3820
GLY3800	Field Geology III	8	8	GLY3700	None
GLY3820	Field Geology for Research	8	8	All third year courses	GLY3810
Total Credits			**120**		

*** ELECTIVE COURSE**

From 2016 year four (4) of the revised the **11BSCG** curriculm is phased in. Year four (4) of the 11BSCG curriculum includes compulsory and elective courses summing up to a total of **120** credits.

From 2016 onwards students chose one of the following 3 options of the elective courses:

1. **GLY3871 Igneous & Metamorphic Petrogenesis** plus any other half course of the elective courses (GLE3821 or GLY3801)
2. **GLY3811 Coal, Gas & Petroleum** plus any other half course of the elective courses (GLE3821 or GLY3801)
3. **GLY3812 Hydrogeology II** plus any other half course of the elective courses (GLE3821 or GLY3801). It is recommended to take GLE3821 Environmental & Engineering Geology II

G.1.2. COURSE DESCRIPTIONS BSC GEOLOGY HONOURS – 11BSCG

FIRST YEAR COURSES

GLY3521: INTRODUCTION TO PHYSICAL GEOLOGY AND SURFACE PROCESSES

Code: **GLY3521**
NQF level: 5
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course assessment: **Continuous 40%**: At least 5 practicals; 2 tests, 1 assignment.
Examination 60%: One 3 hour exam paper.
Prerequisites: None
Co-requisite: GLY3502 Introduction to Earth Systems
Course description: Introduction to the science of geology: physical geology; the rock cycle and the theory of plate tectonics. Minerals and Rocks: minerals, sedimentary, igneous and metamorphic rocks.
Surficial Earth Processes: Geomorphology and land forms; weathering and soil formation; mass wasting; surface and groundwater; shorelines; glaciers and glaciation; deserts and winds.Natural geological hazards and mitigation measures. Internal Earth processes: the Earth's interior; earthquakes; volcanic activity; plate tectonics: continental drift; palaeomagnetism; seafloor spreading; plate boundaries and plate motions. Geological time: the geological time scale; relative dating; correlation; radioactivity and radiometric dating. The Solar system: origin of the Earth.

GLY3502: INTRODUCTION TO EARTH SYSTEMS

Code: **GLY 3502**
NQF level: 5
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course Assessment: **Continuous 40%**: At least 5 practicals; 1-test and at least one assignment.
Examination 60%: One 3 hour exam paper.
Pre-requisites: None
Co-requisite: GLY3521 Introduction to Physical Geology and Surface Processes
Course Description: The Earth as a planet in space; orbit and rotational parameters; Effects of orbit and rotational parameters on glaciers; sediments; and the magnetic field; paleomagnetism; plate tectonics as a unifying principle in the rock cycle; sources of heat in the earth; evolution of planet earth through time; Energy Resources; coal, petroleum; gas; geothermal and solar energy; nuclear energy and other energy sources.

SECOND YEAR COURSES

GLY3600: FIELD GEOLOGY I

Code: **GLY3600**
NQF level: 6
Contact hours: 2 to 3 weeks of field work during recesses, semester breaks, weekends, and public holidays
Credits: 8
Course Assessment: **Continuous 100%**: Field note books, day reports during field trips, written tests, a final report, field trip participation.
Pre-requisites: GLY3521 Introduction to Physical Geology & Surface Processes
Course Description: Introduction to field Mapping Techniques, horizontal and dipping strata; deformed and foliated rocks; igneous bodies, extrusive and intrusive.

GLY3621: INTRODUCTION TO HYDROLOGY

Code: **GLY3621**
NQF level: 6
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course assessment: **Continuous 40%**: At least 5 practicals, 2 tests, 1 assignment.
Examination 60%: One 3 hour exam paper.
Prerequisites: GLY3521 Introduction to Physical Geology & Surface Processes, MAT 3512 Precalculus
Course description: The hydrologic cycle: Inventory of water resources on planet earth; rainfall run-off relationships; stream hydrograph analysis; separation of baseflow and run-off, spring flow analysis. Infiltration & percolation: Infiltration capacity of soil; methods for determining infiltration capacity; soil moisture. Hydraulic properties of geological materials: Porosity; permeability, aquifers & confining units; confined and unconfined aquifers; homogeneity & isotropy in aquifers; geology of groundwater occurrence; primary and secondary permeability in aquifers. Principles of groundwater flow: Darcy's Law, specific discharge, average linear velocity, hydraulic head concept, potentiometric surface; equipotential lines; flow lines & transmissivity. Storage properties of aquifers: Specific storage; storativity and specific yield. Natural chemical evolution of groundwater: Hydrochemical facies; graphical methods of representation of hydrochemical facies (piper diagrams, stiff diagrams & fence diagrams). Overview of Hydrogeological regions in Namibia.

GLY3612: STRATIGRAPHY & GEOLOGICAL MAPPING

Code: **GLY3612**
NQF level: 6
Contact hours: 4 lecture hours per week; 3 practical hours per week.
Credits: 16
Course Assessment: **Continuous 40%**: At least 6 practicals; 2 tests and 1 assignment.
Examination 60%: One 3 hour Exam
Pre-requisites: GLY3521 Introduction to Physical Geology & Surface Processes
Course Description: Principles of stratigraphy, including Walthers's law; applications of stratigraphic principles and type examples; ; basic palaeontology; biostratigraphy; introduction to the geological time scale; geological history of Namibia; geological maps and structures; geological mapping techniques; structures due to deformation.

GLY3632: CRYSTALLOGRAPHY AND MINERAL CHEMISTRY

Code: **GLY3632**
NQF level: 6
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course assessment: **Continuous 40%**: At least 6 practicals; 2 tests and 2 assignments.
Examination 60%: One 3 hour theory paper and one 3 hour practical paper.
Prerequisites: MAT3512 Precalculus, CHM3512 Chemistry 1B
Course description: Crystals, lattices and Crystal symmetry; Crystal morphology: and Crystal projections; Space groups, internal order and translational symmetry; Crystal structures and Crystal chemistry. X-ray crystallography and X-ray diffraction.Mineral chemistry – minerals in the Earth's crust; chemical analytical techniques (X-ray diffraction, X-ray fluorescence, electron microprobe analysis); mineral compositions and variations; exsolutions; calculation of mineral analyses; Graphic representation of mineral composition.

GLY3642: INTRODUCTION TO GEOCHEMISTRY

Code: **GLY3642**
NQF level: 6
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course Assessment: **Continuous 40%**: At least 6 practicals; 2 tests and 1 assignment.
Examination 60%: One 3 hour exam paper.
Pre-requisites: GLY3521 Introduction to Physical Geology & Surface Processes, CHM3512 Chemistry 1B, Mat3512 Precalculus
Course Description: The compositon of the solid earth, its atmosphere, and surrounding universe. The origin and evolution of the earth as a whole, as well as its constituent parts and its structure.Thermodynamics of crystals and minerals, crystal chemistry, magmatism and igneous rocks, sedimentation and sedimentary rocks, isotope geochemistry, Eh-pH diagrams and surface environments, metamorphism as a geochemical process; geochemistry of ore deposits.

GLY3662: INTRODUCTORY PETROLOGY

Code: **GLY3662**
NQF level: 6
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course Assessment: **Continuous 40%**: At least 5 practicals; 2 tests and 1 assignment.
Examination 60%: One 2 hour theory paper and one 2 hour practical paper.
Pre-requisites: GLY3521 Introduction to Physical Geology & Surface Processes
Course Description: Part A: Introduction to Igneous Rocks-their textures, classification of igneous rocks, granites; monzonites; monzodiorites; silicic volcanics; syenites, trachytes; latites; diorites; andesites; gabbros; basalts; ultramafic igneous rocks; nepheline syenites; phonolites; lamprophyres; pyroclastics.
Part B: Introduction to sedimentary rocks-sedimentary textures; argillaceous rocks; aranaceous rocks; calcareous rocks; dolomites; siliceous rocks; ferruginous rocks; carbonaceous rocks.
Part C: Metamorphic rocks- metamorphism, deformation and recrystallisation; metasomatism and melting; the facies classification; progressive regional metamorphism of pelites and basic rocks.

THIRD YEAR COURSES

GLY3700: FIELD GEOLOGY II

Code: **GLY3700**
NQF level: 7
Contact hours: 2 to 3 weeks of field work during recesses, semester breaks, weekends, and public holidays; logging.
Credits: 8
Course Assessment: **Continuous 100%**: Field note books, day reports during field trips, written tests, field reports and field trip participation.
Pre-requisites: GLY3600 Field Geology I
Course Description: Introduction to field Mapping Techniques; folded and polyphase deformed strata; igneous bodies, extrusive & intrusive; high grade metamorphic complexes; stratigraphic logging; sampling; report writing.

GLY3741: GIS

Code: **GLY3741**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course assessment: **Continuous 40%**: At least 5 practicals; 2 tests and 1 assignment.
Examination 60%: One 3 hour exam paper.
Prerequisites: GLY3612 Stratigraphy & Geological Mapping
Course description: GIS platforms; digital mapping techniques; gridding; image analysis including digital elevation models using GIS; modeling with GIS.

GLY3711: MINERALOGY

Code: **GLY3711**
NQF level: 7
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course assessment: **Continuous 40%**: At least 6 practicals; 2 tests and 2 assignments.
Examination 60%: One 3 hour theory and one 3 hour practical papers.
Prerequisites: GLY3632 Crystallography and Mineral Chemistry, CHM3521 Chemistry 1B
Course description: Classification of minerals. Physical properties of minerals: colour, streak, lustre, diaphaneity, luminescence, form, cleavage, parting, fracture, hardness, tenacity; magnetism, electricity, radioactivity, specific gravity, thermal properties. Optical mineralogy: optical properties of minerals: isotropic and anisotropic crystals in polarized light, the polarizing microscope. The optical indicatrix: isotropic, uniaxial and biaxial crystals; opaque minerals. Systematic mineralogy: common rock forming minerals, their occurrence and uses (nesosilicates, sorosilicates, cyclosilicates, inosilicates, phyllosilicates and tectosilicates); Gemstones - their classification and properties; Nonsilicate minerals.

GLY3721: PLATE TECTONICS

Code: **GLY3721**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight
Credits: 8
Course Assessment: **Continuous 40%**: At least 4 practicals; 1-test and at least one assignment.
Examination 60%: One 3 hour exam paper.
Pre-requisites: GLY 3612 Stratigraphy & Geological Mapping
Course Description: Concept of sea floor spreading and plate consumption and generation; the Wilson cycle; plate Motions and stress distribution in plates; geomagnetism-reversals in the Earth's magnetic field, process of rock magnetization; hot spots and plumes, Super continents-how they are recognized; Seismic crustal structure, Benioff zone and earthquake distribution; Plate tectonic settings and rock associations; Crustal Provinces.

GLY3751: SEDIMENTOLOGY

Code: **GLY3751**
NQF level: 7
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course Assessment: **Continuous 40%**: At least 6 practicals; 2-tests and 1 assignment.
Examination 60%: One 3 hour theory exam; one 3 hour practical Exam.
Pre-requisites: GLY3612 Stratigraphy & Geological Mapping, GLY 3662 Introductory Petrology.
Course Description: Sediments cover 75% of continents and most of the ocean floor. They also host most of the mineral deposits in the world. Main topics include: weathering of rocks; paleoclimates; origin and transport of sedimentary materials; deposition of siliciclastic materials; physical properties of sedimentary rocks; sedimentary textures; sedimentary structures; siliciclastic sedimentary rocks; carbonate sedimentary rocks; biochemical and carbonaceous sedimentary rocks; depositional environments including continental marginal marine, deep marine, carbonate and evaporate environments; sedimentary basins and tectonics, sequence stratigraphy and sea level changes.

GLY3761: REGIONAL GEOLOGY OF NAMIBIA

Code: **GLY3761**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course assessment: **Continuous 40%**: At least 5 practicals, 2 tests, 1 assignment.
Examination 60%: One 3 hour exam paper.
Prerequisites: GLY3521 Introduction to Physical Geology & Surface Processes
Course description: Regional Geology of Southern Africa. Cratons and cratonic evolution of Southern Africa ,mobile belts of Southern Africa. Geology of Namibia: from the Archaean to the Pleistocene. Mineral deposits of Southern Africa according to tectonic settings.

GLE3701: ENVIRONMENTAL & ENGINEERING GEOLOGY I

Code: **GLE3701**
NQF level: 7
Contact hours: 2lecture hours per week; 3 practical hours per fortnight
Credits: 8
Course assessment: **Continuous 40%**: At least 5 practicals, 2 tests, 1 assignment.
Examination 60%: One 2 hour exam paper.
Prerequisites: GLY3621 Introduction to Hydrology, GLY3642 Introduction to Geochemistry
Course description: Environmental geochemistry; Types of contaminants in natural water resources; anthropogenic sources of Geochemistry of weathering, equilibrium constants and pollution buffering in different rock types. Groundwater pollution.Engineering properties of rocks and rock masses.Geotechnical site investigations in sedimentary, igneous and metamorphic rocks; Soil description for engineering processes; Reservoirs & Dams structures; Slope stability.

GLY3702: HYDROGEOLOGY I

Code: **GLY3702**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course assessment: **Continuous 40%**: At least 5 practicals, 2 tests, 1 assignment.
Examination 60%: One 3 hour exam paper.
Prerequisites: GLY3621 Introduction to Hydrology, GLY3642 Introduction to Geochemistry
Course description: Groundwater flow equations & flow net analysis; Piezometers, piezometer nests and potentiometric surface map; Regional groundwater flow systems; Ground recharge mechanisms and estimation techniques (Chloride Mass Balance Method, stable isotope method, Hydrograph analysis technique); Aquifer Hydraulics: Theis Equation; computing drawdown caused by a pumping well; determining aquifer parameters from Time-Drawdown data; slug tests, intersecting pumping cones and well interference; effect of hydrogeologic boundaries; aquifer test design; well loss; well efficiency; well specific capacity & optimum pumping rates.
Hydrochemistry: Thermodynamic principles applied to hydrochemistry. Redox reactions; cation exchange; carbonate dissolution & precipitation reactions, silicate weathering. Open and closed systems.

GLY3782: EXPLORATION GEOCHEMISTRY AND GEOSTATISTICS

Code: **GLY3782**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course assessment: **Continuous 40%**: At least 5 practicals; 2 tests and 1 assignment.
Examination 60%: One 3 hour exam paper.
Prerequisites: GLY3642 Introduction to Geochemistry
Course description: Exploration geochemistry: primary and secondary dispersion aureoles and anomalies; geochemical sampling, analysis and interpretation; geochemical patterns of mineral deposits. Geostatistics and geostatistical methods of ore reserve estimation. Laws of distribution for ore deposits; Kriging and error estimation. The course will only cover Linear Geostatistics at this level. Case studies of various deposit types.

GLY3712: STRUCTURAL GEOLOGY I

Code: **GLY3712**
NQF level: 7
Contact hours: 4 lecture hours per week; 3 practical hours per week.
Credits: 16
Course Assessment: **Continuous 40%**: At least 6 practicals; 2-tests and 1 assignment.
Examination 60%: One 3 hour theory exam; one 3 hour practical exam.
Pre-requisites: GLY3612 Stratigraphy & Geological Mapping, MAT3612 Calculus II, GLY3600 Field Geology I
Course Description: The course covers the following topics: Analysis of stress:- its components, the stress ellipsoid, examples of stress in the crust and associated structures with different stress regimes. Analysis of Strain:- the strain ellipsoid, inhomogeneous strain, progressive deformation and strain paths, determination of strain in deformed rocks. Material response to Stress:- brittle behavior, brittle-ductile behavior, ductile behavior, classes of material response to stress and strain. Microstructures:- crystal defects, microstructural development at various grades, deformation mechanisms and associated textures. Primary Structures:- bedding, unconformities, sedimentary versus tectonic structures. Folds:- their description, fold systems and orientation, classification and development of folds. Foliations:- axial plane foliations, fracture cleavage, crenulation cleavage, slaty cleavage, schistosity, differential layering, orientation of foliation in response to strain, and transposed foliations. Lineations:- slickenside striae, lineations associated with folds, lineations due to intersection of foliations, mineral lineations, pebbles, boulders and ooids and the origin of lineations. Faults and Joints Geometrical analysis: scale, style, overprinting and generations, analysis of simple areas, analysis of complex areas. Structural associations. Tectonics.

GLY3732: IGNEOUS & METAMORPHIC PETROLOGY

Code: **GLY3732**
NQF level: 7
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course Assessment: **Continuous 40%**: At least 6 practicals; 2 tests and 2 assignments.
Examination 60%: One 3 hour theory exam; one 3 hour practical Exam.
Pre-requisites: GLY3662 Introductory Petrology, GLY3642 Introduction to Geochemistry, GLY3600 Field Geology I
Course Description: Igneous Petrology: Classification of igneous rocks; The Igneous Rocks: structures and textures; Chemistry, mineralogy and classification. The Phase rule and Phase diagrams. Petrogenesis: movement and modification of magmas. Common igneous rocks: basalts; rhyolites, andesites, granites, granodiorites, alkaline rocks and carbonatites. Metamorphic Petrology: Basics of metamorphism: - grade, metamorphic zones and facies.
Pressure-Temperature depth time paths, types of metamorphism and the geothermal and geobaric gradients.
Progressive metamorphism: Pelites and basic rocks for the greenschist, amphibolite, granulite and eclogite facies.
Fundamental relations of thermodynamics: P-T paths from mineral assemblages. The use of the petrogenetic grid
Calculation of AFM and ACF diagrams and of Mineral formulas. Examination of the Duhem theorem and facies concept, activities and mixing. Gibbs Free Energy.

GLY3762: RESEARCH METHODOLOGY

Code: **GLY3762**
NQF level: 7
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course Assessment: **Continuous 100%**: 5 assignments, 1 test
Pre-requisites: GLY3600 Field Geology I
Course Description: Overview of research. Ethics of research. The scientific method: logic and the scientific, natural observations, formulation of hypothesis, predictions. Types of hypotheses. Summary statistics: measures of central tendency, measures of dispersion. Statistical significance, Testing hypotheses. Experimental (research stydy/project) design.Data collection, Documenting research data and other records.Presentation of data in scientific reports/theses/dissertation. Scientific writing, Plagiarism, Finding and using literature references, Citation of references. Writing a literature review.Report writing. Giving a good oral presentation (including use of powerpoint).

FOURTH YEAR / ARTICULATION COURSES

GLY3810: RESEARCH PROJECT

Code: **GLY3810**
NQF level: 8
Contact hours: Independent Research and Mapping Project by the student, under close supervision from the Lecturer. The lecturer will require an average of one hour contact per week and one week supervision in the field.
Credits: 32
Pre-requisites: All third and second year courses
Co-requisite: GLY3820 Field Geology for Research
Course Assessment: **Continuous 100%**: The assessment is based on: **(i) research report (60%)**, **(ii) presentation (15%)** based on the research report, and **(iii) an oral examination (25%)**. The student will be required to demonstrate competence in research design, conducting research and report writing. The final mark to pass the course is 50% of the combined report, presentation and oral examination results, with a minimum of 50% for each of the three components. **The course can only be passed together with GLY3820 Field Geology for Research; none of the two courses should be failed.**
Course Description: The course will be based on a research topic chosen by a student in the previous year. The field work (GLY 3820, Field Geology for Research) will be compulsory, and one of the products in the project will normally be production of a geological map and cross-section.

GLY3800: FIELD GEOLOGY III

Code: **GLY3800**
NQF level: 8
Contact hours: 2 to 3 weeks of field work during recesses, semester breaks, weekends, and public holidays.
Credits: 8
Course Assessment: **Continuous 100%**: Field note books, day reports during field trips, written tests, a final report, field trip participation.
Pre-requisites: GLY3700 Field Geology II
Co-requisite: GLY3810 Research Project
Course Description: Advanced Field mapping techniques; complexly folded and polyphase deformed strata; polyphase igneous bodies, extrusive & intrusive; high-grade metamorphic complexes, migmatites; geochemical sampling.

GLY3811: COAL, GAS & PETROLEUM

Code: **GLY3811**
NQF level: 8
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course Assessment: **Continuous 40%:** At least 7 practicals; 2-tests and 1 assignment.
Examination: 60%: One 3 hour exam paper.
Pre-requisites: GLY3751 Sedimentology
Course Description: Sedimentary basins and sequence stratigraphy; development of peat; climates associated with coal development; the preservation of coal; the coalification process; petrology of coal and its origins; types of coal and the environments in which they develop; methods of coal exploration; coal mining; Origin of petroleum and gas; migration and accumulation of oil and gas; chemical characteristics of oil; source and reservoir rocks; reservoir fluids; structural and stratigraphic traps; reservoir conditions; introduction to reservoir mechanics; subsurface exploration for oil and gas; exercises in seismic and sequence stratigraphy.

GLY3812: HYDROGEOLOGY II

Code: **GLY3812**
NQF level: 8
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course Assessment: **Continuous 40%:** At least 7 practicals; 2-tests and 1 assignment.
Examination: 60%: One 3 hour theory exam; one 3 hour practical exam.
Pre-requisites: GLY3702 Hydrogeology I
Course Description: Groundwater flow modeling: Types of groundwater flow models; governing equations, numerical & analytical techniques, conceptual model design, boundary conditions; initial conditions; steady state & transient simulations; model calibration; sensitivity analysis; predictive modeling; finite difference & finite element models, different types of computer codes; introduction to modelling with Processing MODFLOW. Groundwater age dating: carbon-14 method; tritium method; chlorine-36 method; chlorofluorocarbons; Stable isotopes: oxygen-18 and deuterium, nitrogen-15 and sulfur-34. Groundwater exploration, development and management: Groundwater resource evaluation, groundwater budgets, conjunctive use groundwater & surface water.

GLY3820: FIELD GEOLOGY FOR RESEARCH

Code: **GLY3820**
NQF level: 8
Contact hours: 2 to 3 weeks of field work / data collection during recesses, semester breaks, weekends, and public holidays
Credits: 8
Course Assessment: **Continuous 100%**: The assessment considers the relevant aspects of the research topic. This is commonly the assessment of the field work planning and design, compilation of geological records (maps, cross-sections, stratigraphic logs), and sample selection and collection.
Pre-requisites: All third and second year courses
Co-requisite: GLY3810 Research Project
Course Description: Field trip / data collection planning; sample selection; sample collection; sample storage and transport. Depending on the research topic: Geological Mapping, Structural Mapping, Stratigraphic Logging, Hydrological Mapping, Pump Tests, Geophysical Surveys, Rock Sampling, Streambed Sampling, Soil Sampling, Geochemical Sampling, Ground- and Surface Water Sampling, In situ analyses (chemical, magnetic, gravimetric, radiometric, etc.)

GLE3821: ENVIRONMENTAL & ENGINEERING GEOLOGY II

Code: **GLE3821**
NQF level: 8
Contact hours: 2 lecture hours per week; 3 hours practical per fortnight
Credits: 8
Course assessment: **Continuous 40%**: At least 5 practicals, 2 tests, 1 assignment.
Examination 60%: One 2 hour exam paper.
Prerequisites: GLE 3701 Environmental & Engineering Geology I
Course description: Stress distribution and elastic theory: soil mechanics; analysis of rock slopes; excavation methods and design; control, maintenance and protection of rock slopes; the influence of groundwater and weathering on rock slope stability. Standard practice in Site Investigation and planning: Engineering solutions to construction problems arising from ground conditions (soils and rocks). Earth materials in relation to engineering; ground engineering problems including ground improvement, mining settlement; foundation engineering; retaining structures; groundwater control. Assessment of contaminated sites: Risk assessment

and the legal framework; reclamation and remediation of mining and contaminated sites; the nature of contaminants; ground improvement methods and risk-based strategies for land reclamation and containment of pollutants; potential environmental effects of landfill waste disposal. Pollution associated with metalliferous deposits: acid mine drainage and its remediation, pollution associated with gold deposits, dangers and its remediation, pollution associated with industrial pollutants of petroleum origin and its remediation. Environmental Impact Assessment: including the aims and objectives of EIA, design and implementation of EIA, screening and scoping, impact prediction and mitigation.

GLY3801: INDUSTRIAL MINERALS AND GEMSTONES

Code: **GLY3801**
NQF level: 8
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight
Credits: 8
Course Assessment: **Continuous 40%**: At least 5 practicals; 2-tests and 1 assignment.
Examination 60%: One 3 hour exam paper.
Pre-requisites: GLY3711 Mineralogy
Course Description: The course will cover two parts; first industrial minerals, the second gemstones. Under industrial minerals the following topics will be covered: Developmental Minerals: economic significance, classification, usage; aggregates and construction materials; dimension stones, and industrial minerals. glass; gypsum; fluorite; clays in general; kaolinite; smectites and montmorrilonites; evaporates; graphite; sillimanite; kyanite; andalusite; limestone and dolomite; magnesite and magnesia; olivine; perlite; phosphates; asbestos; abrasives; nepheline syenite; slate; wollastonite.
The second part will be gemstones: Introduction to gemstones; host rocks and processes of formation; classifications, economics nd valuing; gem mining; gem cutting. precious gemstones: diamonds; sapphires; emerald; aquamarines; Semi-precious stones.

GLY3831: ECONOMIC GEOLOGY

Code: **GLY3831**
NQF level: 8
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course Assessment: **Continuous 40%**: At least 7 practicals; 2-tests and 2 assignment.
Examination 60%: One 3 hour theory exam; one 3 hour practical exam.
Pre-requisites: GLY3711 Mineralogy and GLY 3721 Plate Tectonics
Course Description: Ore forming processes and theory of ore genesis. Classification of mineral resources. Mineral economics: economic recovery of minerals; environmental impact of mineral exploitation; Ore deposit types: magmatic, volcanogenic, volcano- sedimentary and metamorphic. Metals – their uses and economics: ferrous and base metals; precious and rare metals, Petroleum: exploration and production. Geopolical effects of mineral resources and petroleum. Metallogeny: mineral provinces, epochs and plate tectonic controls.

GLY3832: EXPLORATION GEOLOGY AND GEOPHYSICS

Code: **GLY3832**
NQF level: 8
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course assessment: **Continuous 40%**: At least 7 practicals, 2 tests and 2 assignments.
Examination 60%: One 3 hour theory exam; one 3 hour practical exam.
Prerequisites: GLY3712 Structural Geology I
Course description: Exploration techniques: Geological mapping and prospecting. Application of photogeology and remote sensing in mineral exploration. Deep sampling methods: pitting and trenching, auger drilling, hand-held percussion drills, Wagon and Banka drilling; Mineral resource evaluation and ore reserve estimation using conventional methods. Exploration geophysics: principles and applications of seismic, magnetic, gravity, resistivity, electromagnetic induced polarization and radiometric techniques.

GLY3862: STRUCTURAL GEOLOGY II

Code: **GLY 3862**
NQF level: 8
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course Assessment: **Continuous 40%**: At least 5 practicals; 2 tests and 1 assignment.
Examination 60%: One 2 hour theory exam; one 2 hour practical Exam.
Pre-requisites: GLY3712 Structural Geology I, GLY3700 Field Geology II
Course Description: The course will cover the following topics: Microstructures and microtectonics: Advanced analysis of stress: its components, the stress ellipsoid, examples of stress in the crust and associated structures with different stress regimes. Further topics in Strain analysis: the strain ellipsoid, inhomogeneous strain, progressive deformation and strain paths, determination of strain in deformed rocks. Cross-section balancing for regions and smaller areas.Construction of block diagrams; depth to detachment and regional shortening calculations; uplift rates, continents and super continents, cycles of the Earths' magnetic field.Advanced geometrical analysis and stereographic projections for boreholes: scale, style, overprinting and generations, analysis of simple areas, analysis of complex areas. Heat flow in the earths' interior. Geochronology as applied to deformation and crustal evolution.

GLY3822: REMOTE SENSING

Code: **GLY3822**
NQF level: 8
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 8
Course Assessment: **Continuous Assessment 40%**: At least 5 practicals; 2 tests and 1 assignment.
Examination 60%: One 3 hour exam.
Pre-requisites: GLY3712 Structural Geology I
Course Description: The Electromagnetic spectrum; remote sensing systems, how they function and life times; data acquisition and storage; image processing and filtering; interpretation of remote sensing images; photogeology-interpretation and analysis; use of GIS platforms for remotely sensed data; applications of remote sensing.

GLY3871: IGNEOUS & METAMORPHIC PETROGENESIS

Code: **GLY 3871**
NQF level: 8
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight.
Credits: 16
Course Assessment: **Continuous 40%**: At least 7 practicals; 2 tests and 1 assignment.
Examination 60%: One 3 hour theory exam; one 3 hour practical Exam.
Pre-requisites: GLY3732 Igneous & metamorphic Petrology, GLY3711 Mineralogy
Course Description: The petrogenesis of igneous rocks which involves characterization of the source regions of magmas, conditions of partial melting, and subsequent modification of primary mantle derived magmas during transport and storage in magma chambers. This fourth year level course develops upon the basic concepts introduced in the third year level petrology course and relates the origins of rocks to plate tectonic environments.
In metamorphic petrogenesis the central theme of the course is chemical thermodynamics. It is applied in determining mineral stability, exchange vectors, thermobarometry and construction of P-T-t-d paths for a given rock. The importance of metamorphic processes in ore deposit geology will also be emphasized.

G.1.3. LIST OF EQUIVALENT COURSES DURING TRANSITION PHASE

Equivalent courses to the courses offered during the current version of the BSc Geology Honours programme are indicated in the following table.

11BGLY Old BSc Geology Honours Courses (2008-2012)		**11BSCG New BSc Geology Honours Courses (2013-2016)**	
Course Name	**Code**	**Course Name**	**Code**
Introduction to Physical Geology & Surface Processes	GLY3521	Introduction to Physical Geology & Surface Processes	GLY3521
Introduction to Earth Systems	GLY3502	Introduction to Earth Systems	GLY3502
Field Geology I	GLY3600	Field Geology I	GLY3600
Stratigraphy & Geological Mapping	GLY3612	Stratigraphy & Geological Mapping	GLY3612
Introduction to Hydrology	GLY3621	Introduction to Hydrology	GLY3621
Earth Resources	GLY3641	No equivalent; GLY3641 phased out	
Introduction to Geochemisty	GLY3642	Introduction to Geochemisty	GLY3642
Introduction to Petrology	GLY3652	Introductory Petrology	GLY3662
Field Geology II	GLY3700	Field Geology II	GLY3700
Coal, Petroleum & Gas	GLY3701	Coal, Gas & Petroleum	GLY3811
Hydrogeology I	GLY3702	Hydrogeology I	GLY3702
Mineralogy	GLY3711	Mineralogy	GLY3711
Structural Geology I	GLY3712	Structural Geology I	GLY3712
Plate Tectonics	GLY3721	Plate Tectonics	GLY3721
Sedimentology & Palaeontology	GLY3731	Sedimentology	GLY3751
Igneous Petrology	GLY3722	Igneous & Metamorphic Petrology	GLY3732
Metamorphic Petrology	GLY3742		
Regional Geology of Namibia	GLY3761	Regional Geology of Namibia	GLY3761
Research Methology	GLY3762	Research Methology	GLY3762
Environmental and Engineering Geology I	GLE3771	No equivalent, GLE3771 will be re-offered for repeaters	
No equivalent		Environmental & Engineering Geology I	GLE3701
Exploration Geochemistry & Geostatistics	GLY3782	Exploration Geochemistry & Geostatistics	GLY3782
Field Geology III	GLY3800	Field Geology III	GLY3800
Environmental and Engineering Geology II	GLE3801	Environmental & Engineering Geology II	GLE3821
Industrial Minerals & Gemstones	GLY3801	Industrial Minerals & Gemstones	GLY3801
Research Project	GLY3810	Research Project	GLY3810
		Field Geology for Research	GLY3820
Hydrogeology II	GLY3812	Hydrogeology II	GLY3812
Economic Geology	GLY3831	Economic Geology	GLY3831
Exploration Geology & Geophysics	GLY3832	Exploration Geology & Geophysics	GLY3832
Igneous Petrogenesis	GLY3821	Igneous & Metamorphic Petrogenesis	GLY3871
Metamorphic Petrogenesis	GLY3841		
Remote Sensing & GIS	GLY3852	Remote Sensing	GLY3822
		GIS	GLY3741
Structural Geology II	GLY3862	Structural Geology II	GLY3862

G.2. BSC GEOLOGY HONOURS ARTICULATION PROGRAMME - 11BSGA

This programme allows geology NQF level 7 degree holders to upgrade their degree to a full BSc Geology Honours degree at NQF level 8 within one academic year. NQF level 7 degrees are commonly 3-year BSc Geology and 4 year BSc double major degrees. The NQF level 8 BSc Geology Honours degree is usually required to enter a professional career or to enroll for a Master of Science programme.

G.2.1. REGULATIONS

G.2.1.1. Admission Requirements

The following admission criteria shall be met:

1. The applicant should be a UNAM BSc degree holder under the old curriculum with a double major in geology and another course (e.g. chemistry, computer science, economics, physics, statistics, or environmental biology), or a 3-year BSc Geology holder (equivalent to NQA level 7) from another institution.
2. The applicant's BSc degree classification should be Lower Second or higher with a mean % score of 60% and above for the courses of the final and previous year of the respective curriculum.
3. The number of successful applicants will be limited by the availability of resources. Selection will be based on a competency test.

G.2.1.2. Graduation

In **2015** year four (4) of the outphasing **11BGLY** BSc Geology Honours curriculum (see old 11BGLY curriculum) applies. Therefore students have to clear all 11BGLY final year courses (136 credits) in order to articulate from BSc Geology to 11BSGA BSc Geology Honours.

In 2016 year four (4) of the revised **11BSCG** curriculum is phased in. Therefore, from 2016 onwards, all final year NQF level 8 courses (120 credites) of the 11BSCG BSc Geology Honours curriculum shall be cleared in order to articulate from BSc Geology to 11BSGA BSc Geology Honours.

G.2.2. Curriculum Articulation Bachelor of Science in Geology Honours - 11BSGA

QUALIFICATION: BSc Geology Honours - 11BSGA
Students opting for BSc Geology Honours via the 11BSGA Articulation Programme must take all of the following courses:

For **2015** year four (4) (136 credits) of the 11BGLY curriculm applies (see old 11BGLY curriculum). From 2016 year four (4) of the the revised 11BSCG curriculm is phased. In 2016 year four (4) of the 11BSCG curriculum is identical with the one-year 11BSGA curriculum. In 2016 the 11BSGA curriculum includes compulsory and elective courses summing up to a total of **120** credits.

From 2016 onwards students chose one of the following 3 options of the elective courses:

1. **GLY3871 Igneous & Metamorphic Petrogenesis** plus any other half course of the elective courses (GLE3821 or GLY3801)
2. **GLY3811 Coal, Gas & Petroleum** plus any other half course of the elective courses (GLE3821 or GLY3801)
3. **GLY3812 Hydrogeology II** plus any other half course of the elective courses (GLE3821 or GLY3801). It is recommended to take GLE3821 Environmental & Engineering Geology II

ALL THREE OPTIONS ARE SUMMARIZED IN THE NEXT TABLE REFERRING TO THE ONE-YEAR 11BSGA ARTICULATION:

YEAR 1 – 11BSGA

CODE	COURSE NAME	NQF Level	CREDITS	PRE–REQUISITES	CO-REQUISITES
GLE3821* or **GLY3801***	Environmental & Engineering Geology II **or** Industrial Minerals and Gemstones	8 **or** 8	8	GLE3701 / GLY3711	None
GLY3831	Economic Geology		16	GLY3711 & GLY3721	None
GLY3871* **or** **GLY3811*** **or** **GLY3812***	**Igneous & Metamorphic Petrogenesis (option 1) or Coal, Gas & Petroleum (option 2) or Hydrogeology II (option 3)**	8 **or** 8 **or** 8	16	GLY3732 & GLY3711 / GLY3751 / GLY3702	None
GLY3832	Exploration Geology and Geophysics	8	16	GLY3712	None
GLY3822	Remote Sensing	8	8	GLY3712	None
GLY3862	Structural Geology II	8	8	GLY3712 & GLY3700	None
GLY3810	Research Project	8	32	All third year courses	GLY3820
GLY3800	Field Geology III	8	8	GLY3700	None
GLY3820	Field Geology for Research	8	8	All third year courses	GLY3810
Total Credits			**120**		

*** ELECTIVE COURSE**

Course descriptions are to be found under section G.1.3.

G.3. GEOLOGY SERVICE COURSES FOR BSC IN CHEMISTRY HONOURS - 11BSGC

QUALIFICATION: BSc Chemistry Honours with Geochemistry Application 11BSGC

The geology department offers the following service modules to the 11BSGC degree:

G.3.1. REGULATIONS

These courses are not part of the 11BSCG and 11BSGA curricula and therefore the regulations of the Scicence Faculty and the Department of Chemistry apply.

G.3.2. Summary Table of Service Courses to BSc in Chemistry Honours 11BSGC

YEAR 3

CODE	SEMESTER	COURSE NAME	NQF Level	CREDITS	PRE–REQUISITES	CO-REQUISITES
GLC3712	2	Chemical Metallurgy	7	16	CHM3611 & GLY3662	None
GLC3700	1&2	Field Geology	7	8	GLY3521 & GLY3662	None

YEAR 4

CODE	COURSE NAME	NQF Level	CREDITS	PRE–REQUISITES	CO-REQUISITES
GLC3821	Geochemical Analysis	8	8	GLY3662 & GLC3700	None

G.3.3. Course Descriptions Geology Service Courses to 11BSGC

THIRD YEAR COURSES

GLC3700: FIELD GEOLOGY

Code: **GLC3700**
NQF level: 7
Contact hours: 1 to 2 weeks of field work during recesses, semester breaks, weekends, and public holidays
Credits: 8
Course assessment: **Continuous 100%**: Field note books, day reports during field trips, written tests, field reports and field trip participation.
Prerequisites: GLY3521 Introduction to Physical Geology and Surface Processes, GLY3662 Introductory Petrology
Course description: Introduction to field mapping techniques, horizontal and dipping strata, soil profiles, sediments and sedimentary rocks, deformed and foliated rocks, igneous rock bodies - extrusive and intrusive, metamorphic rocks of various metamorphic grades, geochemical sampling techniques for rocks, sediments, soils and water.

GLC3712 CHEMICAL METALLURGY

Code: **GLC3712**
NQF level: 7
Contact hours: 4 lecture hours per week; 3 practical hours per week
Credits: 16
Course Assessment: **Continuous 40%**: Based on assignments and practicals
Examination 60%: One 3 hour exam paper.
Pre-requisites: CHM3611 Inorganic Chemistry, GLY3662 Introductory Petrology
Course Description: Introduction: Characteristics of metals; Resources of metals; Mineral properties; extractive flowsheets. Mineral Processing: Particle sizes and shapes; Communition; Mineral separation; Fluid dynaic principles; Classification; Screening; Gravity concentration; magnetic separation; Electrostatic separation; Flotation; Dewatering.
Pyrometallurgy: Drying, calcination, roasting, smelting, oxide reduction, halide processes, plasma processes, refining.
Hydrometallurgy: Metal leaching; ion exchange; precipitation processes.
Electrometallurgy: Electrical conductance, chemical behaviour, galvanics, elecrolyttc cells, technological aspects, cell operation, electro-winning and electro-refining, electroextraction, electroleaching, electrosynthesis.
Energy and Environment: Extraction and process metallurgy; energy economy; environmental impact; hydrometallurgical processing. Basic Process Flowsheet design: Designing simple extractive metallurgy flowsheets based on the learnt principles.

FOURTH YEAR COURSES

GLC3821: GEOCHEMICAL ANALYSIS

Code: **GLC3821**
NQF level: 8
Contact hours: 2 lecture hours per week; 3 practical hours per fortnight
Credits: 8
Course Assessment: **Continuous 60%**: Based on active participation in tutorials and laboratory practical sessions, preparation of reports, keeping and maintaining a laboratory notebook, quizzes and tests.
Examination 40%: One 2 hour exam.
Pre-requisites: GLY3662 Introductory Petrology, GLC3700 Field Geology.
Course Description: Principles of analytical geochemistry (with focus on solid-state inorganic geochemistry), Sample selection and preparation (including mineral separation, rock crushing, thin-sections), X-ray diffraction (powder and single crystal), X-ray fluorescence (wave-length dispersive, energy dispersive, field- based instrumentation), Scanning electron microscopy (and energy dispersive X-ray semi-quantitative analysis), Electron microprobe analysis (and wave-length dispersive X-ray quantitative analysis), Minor electron-beam techniques: Kukuchi electron back-scatter electron analysis, cathodoluminescence, ICP-MS and laser ablation analysis, Thermal ionization mass spectrometry for isotope analysis, In situ secondary ion mass spectrometry for geochronology, Vibrational spectroscopy (especially micro-Raman spectroscopy).

G.5. MASTER OF SCIENCE IN APPLIED GEOLOGY - 11MSGL

G.5.1. REGULATIONS

G.5.1.1. ADMISSION REQUIREMENTS

To register for an MSc postgraduate degree programme a candidate must hold a BSc Honours degree in Geology (NQF level 8) or a recognized equivalent qualification. The applicants will be accepted on the basis of their undergraduate record. An average mark of minimum 60% is required. The number of successful applicants will be limited by the availability of resources.

G.5.1.2. MODE OF DELIVERY

The programme is offered on a full-time basis on a block course schedule over a period of two years for full time students. The mode of teaching will include lectures, seminars, laboratory practicals, field practicals, site visits, case studies and group projects.

Student intake into the first year will be done every two years so that courses are offered only every second year (first year courses in odd years [i.e. 2017, 2019,…] and second year courses in the even years [i.e. 2016, 2018]. **Next student intake is 2019**.

G.5.1.3. DURATION OF STUDY

The study duration shall be two years for full time students. The maximum study period shall not exceed three years. An extension of registration beyond the stipulated maximum study period may be granted by relevant committees if valid reasons are advanced.

G.5.1.4. ADVANCEMENT AND PROGRESSION RULES

Students must pass all first year courses (132 credits) in order to advance to the second year of study. A candidate must pass all first year coursework examinations before commencing with the MSc thesis.

G.5.1.5. MAXIMUM NUMBER OF COURSES PER YEAR

The maximum number of courses in year one are eleven (11) with a total of **132 credits**, including field work, technical visits and industrial attachments. The maximum number of courses in the second year is six (6) with a total of **72 credits**. The MSc thesis (60 credits) is scheduled in the second year.

G.5.1.6. ASSESSMENT CRITERIA

Unless otherwise indicated, assessment is based on a written examination and continuous assessments (CA) with a **50 (exam):50 (CA)** weighting for each course. The final-year master thesis is based on a research project. A minimum of 50% is required to pass each course and **a student is required to attend 80% of all lectures and practicals**. The thesis will be supervised by a PhD holder and examined by at least one internal and one external examiner of a recognized institution.

G.5.1.7. REQUIREMENTS FOR QUALIFICATION AWARD

This qualification will be awarded to candidates credited with all **264 credits**, and who have met the requirements of the compulsory courses, industrial attachments, field and laboratory practicals as well as the project thesis. In addition students are required to provide **proof of competency of at least one foreign language other than English**. It is recommended that students should learn a language that is relevant in internationally operating companies such as French, Russian, German, Spanish or Chinese. The language course(s) will be offered in consultation with the UNAM Language Centre (non-degree purposes).

Student will graduate with an MSc in Applied Geology, either majoring in **Exploration & Economic Geology** or majoring in **Environmental Geology & Hydrogeology** depending on the elective courses a student chooses in year two of the programme.

G.5.2. CURRICULUM MASTER OF SCIENCE IN APPLIED GEOLOGY - 11MSGL

Students opting for an Applied Master in Geology (11MSGL) must take the following courses:

YEAR 1

CODE	COURSE	NQF Level	CREDITS	PRE-/CO-REQUISITE	COMPULSORY
UAE5819	Academic Writing for Postgraduate Studies	9	NCB	None	Yes
GLY5901	Applied GIS and Remote Sensing	9	12	None	Yes
GLY5921	Mineral Processing and Metallurgy	9	12	None	Yes
GLY5902	Applied Geochemistry	9	12	None	Yes
GLY5922	Applied Geophysics	9	12	None	Yes
GLY5911	Project Management, Economics and Law	9	24	None	Yes
GLY5941	Research methodology	9	12	None	Yes
GLY5912	Field Techniques and Technical Visits	9	24	None	Yes
GLY5919	Industry Internship	9	24	None	Yes
Total Credits			**132**		

YEAR 2

CODE	COURSE	NQF Level	CREDITS	PRE-/CO-REQUISITE	COMPULSORY
Courses for Major: Exploration & Economic Geology					
GLA5901	Ore Forming Processes	9	12	GLY5902, GLY5912	Yes
GLA5911	Exploration Techniques, Methodology, and Economics	9	24	GLY5901, GLY5912, GLY5922	Yes
GLA5931	Ore Body Modelling and Evaluation	9	24	GLY5912	Yes
GLA5921	Underground and Open Pit Mining	9	12	GLY5921, GLY5912	Yes
Courses for Major: Environmental Geology & Hydrogeology					
GLE 5911	Hydro-geochemistry	9	24	GLY5902	Yes
GLE 5931	Protection and Management of Water Resources	9	24	GLY5902, GLY5911	Yes
GLE5941	Environmental Impact Assessment and Sustainable Development	9	12	GLY5911, GLY5912	Yes
GLE5961	Impact of Mining Activities on Aquatic Systems	9	12	GLY5902, GLY5911	Yes
Courses for both Majors					
GLY5900	Master Thesis (Mini Thesis)	9	60	All first year courses	Yes
Total Credits			**132**		

G.5.3. COURSE DESCRIPTIONS MASTER OF SCIENCE IN APPLIED GEOLOGY - 11MSGL

FIRST YEAR COURSES

GLY5901: APPLIED GIS AND REMOTE SENSING

Code: **GLY5901**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Course assessment: **Continuous 50%**: At least 5 practicals; 2 tests, 2 assignments.
Examination 50%: One 2 hour exam paper.
Course description: Basics of remote sensing: systems, scanners, data availability, data formats, data processing software; Applications RS: topographic analysis, relief and landform, hydrological analysis (streams, drainage patterns, flooding and flood control), introduction to hydrotop-concept and application for recharge studies, evapotranspiration determination from RS data, vegetation indices, landuse, erosion, Permeability classification, identification karstic features, geometry of joint systems; Resource satellites; Remote sensing applications for mineral resource exploration; techniques used to diminish vegetation effect; soil-rock ratios; uses of spectral curves and digital data analysis; image interpretation keys; image classification and interpretation; using collateral information; uses of thermal infrared images; radiometric and ratio images; image processing, restoration, enhancement and information extraction; using RS images from ocean surfaces.
GIS: data formats, data processing software, data exchange, data sources, digitising, database management, regionalisation of data, data analysis for routes, data merging including RS data, digital elevation models, digital geological maps, engineering maps, hydrogeological maps, vulnerability mapping based on spatial patterns, GIS data as input for various models/modelling software packages.

GLY5921: MINERAL PROCESSING AND METALLURGY

Code: **GLY5921**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Course Assessment: **Continuous 50%**: At least 5 practicals; 2 tests, 2 assignments.
Examination 50%: One 2 hour exam paper.
Course Description: Comminution: role of comminution. Comminution laws.Basic principles of crushing and crushing equipment; grinding and grinding equipment. Screening and sieve analysis. Concentration: gravity concentration and equipment, magnetic and electrostatic separation and equipment, floatation: principles. Solid and Liquid separation: sedimentation, thickening and filtration. Basic flowsheet design for selected minerals coal preparation, heavy sands processing. Basic Extractive Metallurgy: pyrometallurgy, hydrometallurgy, electrometallurgy.

GLY5902: APPLIED GEOCHEMISTRY

Code: **GLY5902**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Course Assessment: **Continuous 50%**: At least 5 practicals; 2 tests, 2 assignments.
Examination 50%: One 2 hour exam paper.
Course Description: Thermodynamic principles and concepts; Activity coefficients and speciation; CO2 Acids and Bases; Speciation modelling using PHREEQC; Oxidation and Reduction; Iron, Sulphur and Nitrogen Geochemistry; Geochemical Reactions in PHREEQC Implicit Equilibrium, Mixing, Dissolution, Precipitation, Co-precipitation and Redox Reactions; Sorption and Ion Exchange (theory and PHREEQC modelling); Carbonates, Silicates, Clay Minerals and Solid Solutions; Reaction Path Modelling; PHREEQC carbonate geochemistry; Reactive Transport – Modelling Mine Waste Seepage; Common Error Modelling; Radionuclides in Dust, Surface Soil, Surface water and Groundwater; Analytic techniques for major, minor and trace element chemistry; Isotope analytic techniques.

GLY5922: APPLIED GEOPHYSICS

Code: **GLY5922**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Course assessment: **Continuous 50%**: At least 5 practicals; 2 tests, 2 assignments.
Examination 50%: One 2 hour exam paper.
Course description: Theoretical considerations, data acquisition, and data processing and interpretation, of magnetic, gravity, radioactivity, resistivity, Induced Polarization, electromagnetic, seismic and geophysical well logging methods; with the objective of locating concentrations of natural resources and defining their extent; improved techniques for calculating gravity fields, the use of proton-precession and optically-pumped magnetometers, improved quality of seismic data, magnetotelluric as a practical exploration method, new electromagnetic exploration methods, the use of gamma-ray spectrometers in radioactive exploration, and improved well-logging techniques.

GLY5911: PROJECT MANAGEMENT, ECONOMICS AND LAW

Code: **GLY5911**
NQF level: 9
Contact hours: 56 h lectures and 72 h practical.
Credits: 24
Course Assessment: **Continuous 50%**: At least 3 seminars; 2 tests, 2 assignments.
Examination 50%: One 3 hour exam paper.
Course Description: Role of a geologist: legislation and codes of a rig geologist; drill rig management - covers program planning and daily rig management; Regolith geochemistry and logging - regolith terminology, architecture of the regolith profile; practical logging workshop; Field sections, reporting and data management - daily data management and reporting, importance of using field sections.Project management: project initiation, project planning, project implementation and project termination; basic concepts of project and project management, project selection, project definition, project organization structure, team building, communication and conflict management, project planning methods and techniques, resource allocation, project monitoring and control, project termination. Economics: Microeconomics: elements of economics; demand and supply; elasticity; applied market analysis; utility; competition and monopoly; labour markets. Macroeconomics: inflation and the business cycle; Keynesian aggregate demand; money and interest rates; central banking and monetary policy; world trade and the balance of payments; unemployment. Financial accounting: nature of costs, product costing, cost accounting, profit-volume relationships, financial statements. Introduction to budgeting.Introduction to marketing.Long and short-term decision making. Law: Environmental law - principles and norms; - Environmental governance; - Environmental planning and assessment; - Administrative Justice; - Enforcement and Compliance; - Pollution law; - Mining and energy law; - Biodiversity law; - Water law; - Compliance and enforcement in environmental law. Health & Safety in the exploration and mining environment: Dust and associated health risks (calcidosis, silicosis). Radon emissions, toxicity of heavy metals, sulfides and arsenides. Measure to reduce hazardous emissions during exploration and mining, protective measures. Drilling safety: hazard identification and risk reduction around the drill rig; site visits to operating drill rigs. Environment: best practice environmental procedures and implications for drilling activities; cultural awareness.

GLY5941: RESEARCH METHODOLOGY

Code: **GLY5941**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical
Credits: 12
Course assessment: **Continuous 100%**: At least 5 assignments and one written test.
Course description: Overview of research. Ethics of research. The scientific method: logic and the scientific method, natural observations, formulation of hypothesis/research question, predictions. Types of hypotheses. Summary statistics: measures of central tendency, measures of dispersion. Statistical significance, Testing hypotheses. Experimental (research study/project) design.Data collection, documenting research data and other records.Presentation of data in scientific reports/theses/dissertation. Data processing: Data base management, data format conversions, header information
Scientific writing: Plagiarism, finding and using literature references, citation of references. Writing a literature review.Report writing. Giving a good oral presentation (including use of powerpoint).

GLY5912: FIELD TECHNIQUES AND TECHNICAL VISITS

Code: **GLY5912**
NQF level: 9
Contact hours: 18 days.
Credits: 24
Course Assessment: **Continuous 100%**: 50% of the continuous assessment comprises a minimum of 5 practicals, 2 written tests, and 2 assignments, a final report and presentation will contribute to the remaining 50% of the assessment.
Course Description: Geological maps and cross-sections: Introduction to the interpretation of complex geological maps and sections; balanced cross sections; Review of stratigraphic projections, stereographic projection of borehole data; Petro fabrics; deformation in low and high grade rocks; deformation associated with plutons; Domes and basins; Analysis of data from deformation experiments; microfabrics; microtectonics; stress mapping for ore deposit geology; structural geology of ore deposits; fluid-flow mineralization and deformation; finite strain analysis in 2D – 3D; Strain markers in ore deposits. On site field studies and technical visit: Field work in selected areas of a specific geological/environmental/technical interest for research purposes and technical visits to relevant exploration companies, mines industrial plants and enterprises.

GLY5919: INDUSTRY INTERNSHIP

Code: **GLY5919**
NQF level: 9
Contact hours: Face to face consultations with supervising lecturer and/or coordinating lecturer on a regular basis.
Credits: 24
Course Assessment: **Continuous 100%**: daily field/lab logbook (30%), Company assessment (10%), Lecturer assessment (10%), Final Report (30%), and Seminar Presentation (20%).
Course Description: During Industrial Internship I, students will conduct project work under company supervision in areas of geological/environmental/technical interest for research purposes and industrial internships with relevant exploration companies, mines, industrial plants and enterprises. During attachment, students will be visited at their work place twice by their Lecturers.

SECOND YEAR COURSES: BOTH MAJORS

GLY5900: MSC THESIS (MINI THESIS)

Code: **GLY5900**
NQF level: 9
Contact hours: Face to face consultation with supervisor and coordinator on a regular basis.
Credits: 60
Prerequisites: Pass all first year courses
Course assessment: **Continuous 100%**: The assessment is based on: **(i) Research report (60%)**, **(ii) presentation (25%)** based on the research report, and **(iii) an oral examination (15%)**. The student will be required to demonstrate competence in research design, conducting research and report writing. The final mark to pass the course is 50% of the combined report, presentation and oral examination results, with a minimum of 50% for each of the three components.
Course description: Research proposal: preparation of research proposal according to recommended UNAM guidelines based on a selected research topic in consultation with project supervisors; submission of proposal to relevant postgraduate study committees for approval. Research project: conducting research, including desk study, field work, sampling and data collection, sample and data analysis, data interpretation.Research thesis: writing of thesis in accordance with recommended UNAM guidelines.

SECOND YEAR COURSES: MAJOR IN EXPLORATION & ECONOMIC GEOLOGY

GLA5901: ORE FORMING PROCESSES

Code: **GLA5901**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Prerequisites: GLY5902, GLY5912
Course assessment: **Continuous 50%**: At least 5 practicals; 2 tests, 2 assignments.
Examination 50%: One 2 hour exam paper.
Course description: Igneous ore-forming processes: magmas and metallogeny, partial melting and crystal fractionation, liquid immiscibility, mineralisation in layered mafic intrusions; Magmatic-hydrothermal ore-forming processes: composition and characteristics of magmatic-hydrothermal solutions, pegmatites and granite-related ore-forming processes, fluid-melt trace

element partitioning, formation of porphyry deposits of Cu-Mo-W-Au-Sn, formation of skarn deposits, epithermal Au-Ag-(Cu) deposits.Hydrothermal ore-forming processes: origin and movement of hydrothermal fluids in the Earth's crust, precipitation mechanisms, fluid/rock interactions, metal zoning and paragenetic sequences, formation of VMS and SEDEX deposits, deposits associated with metamorphic, connate and meteoric fluids.Surficial and supergene ore-forming processes: principles of chemical weathering, lateritic, clay, and calcrete-hosted deposits; supergene enrichment in near surface deposits.Sedimentary ore-forming processes: Clastic sedimentation and heavy mineral (placer) concentrations; chemical sedimentation of banded iron-formations, phosphorites and evaporites; fossil fuels.

GLA5911 EXPLORATION TECHNIQUES, METHODOLOGY, AND ECONOMICS

Code:	**GLA5911**
NQF level:	9
Contact hours:	56 h lectures and 72 h practical.
Credits:	24
Prerequisites:	GLY5901, GLY5912, GLY5922
Course Assessment:	**Continuous 50%**: At least 5 practicals; 2 tests, 2 assignments.
	Examination 50%: One 3 hour exam paper.

Course Description: Geological exploration techniques: geological mapping and prospecting; exploration guides for various ore deposit types (magmatic, magmatic-hydrothermal, hydrothermal, metamorphic, sedimentary); application of remote sensing techniques in mineral exploration. Exploration drilling methods and techniques (percussion and diamond drilling, reverse circulation, rotary drilling for oil and gas). Geophysical exploration techniques: principles and techniques for mineral resource exploration using magnetic, gravity, induced polarization, electromagnetic, radioactivity and seismic surveys; Interpretation and field examples. Ore reserve estimations: principles of reserves and resource classifications; orebody evaluation; conventional plan and section methods, grade evaluation, reserve calculation. Fossil Fuels: Methods of exploration and exploitation; Nuclear Fuels, Carbonaceous Fuels (coal, conventional gas, petroleum, coal-bed methane, shale gas) Exploration geochemistry: geochemical prospecting, choice of methods, optimizing survey techniques, geochemical survey parameters, survey organization and operation; mechanical and biological dispersion; dispersion patterns; mineral deposit geochemistry.

GLA5931: ORE BODY MODELLING AND EVALUATION

Code:	**GLA5931**
NQF level:	9
Contact hours:	56 h lectures and 72 h practical.
Credits:	24
Prerequisites:	GLY5912
Course Assessment:	**Continuous 50%**: At least 5 practicals; 2 tests, 2 assignments.
	Examination 50%: One 3 hour exam paper.

Course Description: Introduction to geostatistics in geology: examples as used in aquifer analysis and porosity measurement; in structural geology stress mapping; in economic geology resource evaluation.

Overview of resource estimation: decision making and resource estimation; scarcity of data, sample quality and effect and influence of geology; Estimation at different stages of a project: evaluation; systematic sampling; infill sampling; drilling methods and errors associated with them; sampling errors; overcoming errors in sampling.

Overview of resource estimation: polygons, sections, panels from U/ground; inverse distance; Kriging. Systematic Resource Estimation Practice; Statistical Fundamentals and their limitations in geology: statistics and geostatistics; probability; random variables; cumulative distribution functions; moments and expected values; covariance and correlation; linear regression; Gaussian distribution; Lognormal. Regionalised variables and variograms: randomness and ore bodies; probabilistic models; geostatistical approach; random functions; stationarity. The variogram: main features, uses of variograms, what a variogram can do and how it can be used and imporved. Variography: the science and art of variography; the aims of structural analysis; practical aspects; 1-D variograms; 2-D variograms; 3-D variograms; experimental variograms; additivity in variography; estimation of error in variography; models of variograms; models for nugget effect; why we must not fit variograms bt computers; troublesome variograms; combining models; other approaches to calculating variograms; Case studies and effect on ore reserves. Dispersion variance and support effect: dispersion as a function of support; variances of dispersion within a given volume, V; change of support and regularisation. Extension and Estimation Variances: concept of extension variance; formula of extension variance; extension and dispersion variance; factors affecting extension variance; Extension variance and dispersion variance; geometry of mineralisation; sampling patterns. Kriging: estimation; how kriging works; kriging equations; properties of kriging; Kriging practice. Operational Geostatistics: Grade control; why kriging? Variogram as a tool; Block estimation; Kriging technique; Indicator models; Non-linear geostatistics; Multi-variate geostatistics. Computer techniques for geological characterization; 3D Geological Modelling; how to combine various 3D spatial data sets to solve problems in 3D geological settings; introduction to scripting, gridding algorithms, constructing 3D geological computer models of mineral deposits, gridding of faulted and folded geological data, geostatistical simulation, facies modelling, and calculating the volume of ore. Case studies from mining. Application of modeling software: assessment of mineralisation to help determine the potential project value; processing of data to identify trends leading to exploration and evaluation targets. Interpretation of structures of high grade zones within the full data set. Combining maps, cross-sections, wireframes, polylines, points, drillholes, and GIS data to create a realistic, consistent and reliable 3D interpretation; slicing options. Structural data modeling: incorporating measurements of planar features into the model for the development of more geologically realistic models; Vein modelling: interval selection in modelling laminar structures.

Lithological modelling: how to model complex lithologies. Grade modelling for enhanced visualization of trends and to produce a range of ore-waste cut-off. Importing geo-reference and display maps and sections to provide geological context. Enhancing visualization and understanding of data based on 3D measurement tools, the transparency function, layering GIS and draping on topography.

GLA5921: UNDERGROUND AND OPEN PIT MINING

Code: **GLA5921**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Prerequisites: GLY5912, GLY5921
Course assessment: **Continuous 50%**: At least 5 practicals; 2 tests, 2 assignments.
Examination 50%: One 2 hour exam paper.

Course description: Introduction to underground mining: Selection of mining techniques; Shaft sinking and layouts. Major development layout; level, horizon and panels methods of development. Mining systems: mining methods of extracting ore. Mine design parameters and mining processes in underground operations. Mechanization of operations and special technologies. Trackless mining: selection and operation of underground trackless equipment for massive mining. Introduction to open-pit mining: Selection of open pit mining; Open pit design; slope stability; haul road design; drilling and blasting patterns; economics and stripping ratios; economic cut-offs; pit optimization. Quarry operations; working platforms; bench width; optimum depth; Strip mining of mineral deposits; environmental considerations; dragline operations. Marine mining; dredging; mechanized earth- moving; hydraulic mining; equipment selection and power systems. Formation of soils and rocks: soil and rock types. Properties of soils and rocks: classification; Stresses in soils: effective stresses, failure theories. Shear strength of soils. Settlement; elastic, plastic (consolidation).

SECOND YEAR COURSES: MAJOR IN ENVIRONMENTAL GEOLOGY & HYDROGEOLOGY

GLE5911: HYDRO-GEOCHEMISTRY

Code: **GLE5911**
NQF level: 9
Contact hours: 56 h lectures and 72 h practical.
Credits: 24
Prerequisites: GLY5902
Course Assessment: **Continuous 50%**: At least 3 seminars; 2 tests, 2 assignments.
Examination 50%: One 3 hour exam paper.

Course Description: Non-reactive tracer transport: advection and dispersion; reactive transport: precipitation and dissolution, sorption, filtration, degradation and persistence; transport equations; introduction to modelling packages; finite differences, finite elements; modelling calibration; inverse problems. Hydrogeochemistry of geothermal water: origin & occurrence of geothermal water; description and presentation of geothermal waters; classification of geothermal waters; geothermal waters in Namibia; usage of geothermal waters; geothermal water as an alternative energy source

GLE5931: PROTECTION AND MANAGEMENT OF WATER RESOURCES

Code: **GLE5931**
NQF level: 9
Contact hours: 56 h lectures and 72 h practical.
Credits: 24
Prerequisites: GLY5902, GLY5911
Course assessment: **Continuous 50%**: At least 3 seminars; 2 tests, 2 assignments.
Examination 50%: One 3 hour exam paper.

Course description: Groundwater recharge: direct, indirect, localized groundwater recharge; interaction surface water – groundwater; groundwater recharge in different climates; soil water balance modelling; precipitation – runoff models; precipitation regionalisation; evapotranspiration quantification; streamflow analysis; hydrograph analysis; separation techniques; tracer studies including isotopic studies; forward and inverse techniques; aquifer response to pumping; artificial (managed) groundwater recharge.Water Sources and Quality: Different water supply sources; water quality standards; water treatment technology (potable); water supply infrastructure; basic waste water infrastructure and treatment technologies; urban groundwater management; integrated water resource management; exploration, evaluation and exploitation of groundwater resources; Waste/Risk: land fill disposals; containments of waste disposals; geomembranes, combined liners; monitoring of waste/landfills; monitoring of sewage; contamination sources; saltwater intrusion; vulnerability of aquifers: concept and background.

GLE5941: ENVIRONMENTAL IMPACT ASSESSMENT AND SUSTAINABLE DEVELOPMENT

Code: **GLE5941**
NQF level: 9
Contact hours: 28 h lectures and 36 h practical.
Credits: 12
Prerequisites: GLY5911, GLY5912
Course Assessment: **Continuous 50%**: At least 5 practicals; 2 tests, 2 assignments.
Examination 50%: One 2 hour exam paper.

Course Description: Relevant environmental acts and laws in Namibia; international approaches to EIA; assessment techniques for EIA; basic environmental methodologies; monitoring of water, soil & air: relevance of time series, spatial set up and monitoring parameters; tolerable daily intake, - disability-adjusted-life years approach, lowest-observed-adverse effect levels; uncertainty factors; toxicological review of relevant substances mobilized by mining.

GLE5961: IMPACT OF MINING ACTIVITIES ON AQUATIC SYSTEMS

Code:	**GLE5961**
NQF level:	9
Contact hours:	28 h lectures and 36 h practical.
Credits:	12
Prerequisites:	GLY5911, GLY5902
Course Assessment:	**Continuous 50%**: At least 5 practicals; 2 tests, 2 assignments.
	Examination 50%: One 2 hour exam paper.

Course Description: Basic hydrobiology including basic groundwater biology; contaminants derived from mining activities (Focus: gold, uranium, zinc, copper, manganese mining); dewatering of mines; subsidence; aquifer vulnerability: methodology for assessment and presentation of results; remediation: in-situ, on-site, off-site methods; active treatments; monitored/enhanced natural attenuation.

G.6. MASTER OF SCIENCE IN PETROLEUM GEOLOGY -11MSPG

G.6.1. REGULATIONS

G.6.1.1. ADMISSION REQUIREMENTS

To register for the Master of Science in Petroleum Geology, a candidate must hold a BSc Geology Honours degree (NQF level 8) or a recognized equivalent qualification. The applicants will be accepted on the basis of their undergraduate record (grades and course contents). An average mark of 60% is required. For overseas students equivalent qualifications are required. International students whose tertiary education was not in English must proof proficiency in English (IELTS 7.0 or better).For all candidates interviews shall be considered to confirm their suitability for admission. The number of successful applicants will be limited by the availability of resources.

G.6.1.2. MODE OF DELIVERY

The programme is offered on a full-time basis on a block course schedule over a period of two years for full time students. The mode of teaching will include lectures, seminars, laboratory practicals, field practicals, site visits, case studies, and group projects. Examinations shall follow each teaching block within a reasonable time frame (3-10 days).

G.6.1.3. DURATION OF STUDY

The study duration shall be two years for full time students. The maximum study period shall not exceed three years. An extension of registration beyond the stipulated maximum study period may be granted by relevant committees if valid reasons are advanced.

G.6.1.4. ADVANCEMENT AND PROGRESSION RULES

Students must pass all first year courses in order to advance to the second year of study.

G.6.1.5. MAXIMUM NUMBER OF COURSES PER YEAR

The maximum number of courses in year one are one full courses and nine half course for a total of **132 credits**, including field work. The MSc Thesis and Industry Internship are scheduled in the second year, for a total of **132 credits**. The MSc thesis contributes with 120 credits.

G.6.1.6. ASSESSMENT CRITERIA

Unless otherwise indicated, assessment is based on a written examination and continuous assessments (CA) with a **50 (exam):50 (CA)** weighting for each course. Examinations shall follow each teaching block within a reasonable time frame (3-10 days). The final-year master thesis is based on a research project. A minimum of 50% is required to pass each course and **a student is required to attend 80% of all lectures and practicals**. The thesis will be supervised by a PhD holder and examined by at least one internal and one external examiner of a recognized institution.

G.6.1.7. REQUIREMENTS FOR QUALIFICATION AWARD

This qualification will be awarded to MSc candidates credited with all **264 credits**, and who have met the requirements of the compulsory courses, industrial attachments, field and laboratory practicals as well as the MSc Thesis. In addition students are required to provide proof of **competency in first aid**. This competency should strongly relate to field activities, in particular field trips. It is required that students obtain a competency certificate from a recognized institution that offers tailor made training. According course(s) are, for example, offered by e-med rescue. It is recommended that students obtain their certificate before commencing any coursework.

G.6.2. CURRICULUM MASTER OF SCIENCE IN PETROLEUM GEOLOGY - 11MSPG

Students opting for a Master of Science in Petroleum Geology (11MSPG) must take the following courses:

YEAR 1

CODE	COURSE	NQF Level	CREDITS	PRE-REQUISITE	COMPULSORY
Semester 1					
UAE5819	Academic Writing for Postgraduate Studies	9	NCB	None	Yes
GLY5941	Research Methodology	9	12	None	Yes
GLP5901	Sedimentology and Sedimentary Basins	9	12	None	Yes
GLP5921	Petroleum Systems	9	12	None	Yes
GLP5941	Geophysics, Seismic Acquisition and Processing	9	12	None	Yes
GLP5961	Petrophysics	9	12	None	Yes
Semester 2					
GLP5902	Sequence Stratigraphy and Stratigraphic Forward Modelling	9	12	None	Yes
GLP5912	Subsurface Geology & Seismic Interpretation	9	24	None	Yes
GLP5942	Sedimentary Petrography and Organic Geochemistry	9	12	None	Yes
GLP5962	Reservoir Geology and Prospect Analysis	9	12	None	Yes
GLP5990	Field Trip – Onshore Analogues	9	12	None	Yes
Total Credits			**132**		

YEAR 2

CODE	COURSE	NQF LEVEL	CREDITS	PRE-REQUISITE	COMPULSORY
GLP5999	Industry Internship	9	12	All 1st year courses	Yes
GLP5900	Master Thesis	9	120	All 1st year courses	Yes
Total Credits			**132**		

G.6.3. COURSE DESCRIPTIONS MASTER OF SCIENCE IN PETROLEUM GEOLOGY - 11MSPG

FIRST YEAR COURSES

GLY5941: RESEARCH METHODOLOGY

Code: **GLY5941**
NQF level: 9
Contact hours: 28 h lectures and 21 h practical.
Credits: 12
Course assessment: **Continuous 100%**: A minimum of 2 assignments, 1 written test, and 1 seminar presentation. The students will be required to demonstrate competence in developing a research topic based on a research design, including proposal writing, literature review and data presentation.
Course description: Overview and ethics of research. The scientific method: logic and the scientific method, natural observations, formulation of hypothesis/research question, predictions; Types of hypotheses. Summary statistics: measures of central tendency, measures of dispersion. Statistical significance and testing hypotheses; experimental (research study/project) design. Data collection, geo-statistical methods for data inter- and extrapolation used in spatial geological models (kriging, gridding, 3D geological models), documenting research data and other records, presentation of data in scientific reports/theses/dissertation; Field trips and field surveys: Planning, design and execution; identification and avoidance of hazards associated with field work; safety measures, lost and first aid procedures;Scientific writing: Plagiarism, finding and using literature references, citation of references. Write a literature review, report writing. Givinga good oral presentation (including use of PowerPoint).

GLP5910: SEDIMENTOLOGY AND SEDIMENTARY BASINS

Code: **GLP5901**
NQF level: 9
Contact hours: 28 h lectures and 21 h practical.
Credits: 12
Course assessment: **Continuous 50%**: A minimum of 1 written test, 2 assignments, and 1 seminar presentation
Examination 50%: One 2 hour exam paper.
Course description: Sedimentary Processes: Weathering, erosion, transport mechanisms, current action, diagenesis; Facies Models: Construction of facies models, environmental interpretation: fluvial, lacustrine, shallow marine, deep marine, carbonate environments, influence of climate and climatic evolution on depositional facies; Basin Evolution: Geotectonic settings: subduction, fore-arc, back-arc, foreland, folded thrust belts, rift, failed rift, continental sags, cratonic basins, transtensional basins, basin inversion; Rifted Volcanic Passive Margins: Examples from Namibia, Angola, South America and other regions; Concept of Sequence Stratigraphy: Recognition of base level fluctuations, changes in accommodation space, subsidence, transgression, regression, progradation, retrogradation, aggradation.

GLP5921: PETROLEUM SYSTEMS

Code: **GLP5921**
NQF level: 9
Contact hours: 28 h lectures and 21 h practical.
Credits: 12
Course assessment: **Continuous 50%**: A minimum of 1 written test, 2 assignments, and 1 seminar presentation
Examination 50%: One 2 hour exam paper.
Course description: Upstream Exploration and Production Business: Disciplines involved - exploration vs. production, field life-cycle, markets and cost elements, environmental impact assessment, socio-economy of HC exploration and production, Southern African licencing frameworks;Accumulation of Organic Matter: depositional settings for accumulation of peat, sapropel and gythia, preservation and high primary OM production models, biogenic OM sources, recognition of origin of biogenic origin of OM;HC Source Rocks and HC generation: Formation of kerogen, macerals and origin of OM, indicators of dysoxic/anoxic depositional conditions, maturation and kerogene conversion – katagenesis, metagenesis, van Krevelen diagram, evaluation of HC potential using Rock Eval and other parameters; Oil density, chemistry of hydrocarbons; Migration Pathways and Migration: Concept of porosity and permeability, primary and secondary porosity/permeability, faults and fracture zones as migration avenues, permeable lithologies as migration avenues, primary migration/expulsion of HC, secondary migration, driving forces vs. restricting forces for HC movement; Reservoir Lithologies: Siliciclastic and carbonate reservoir lithologies, depositional geometries of reservoir rocks; depositional environments for reservoir lithologies; Seal Lithologies: Lithologies such as shales, salts and carbonates, requirements regarding thickness and lateral extent, depositional environments for seal rocks; Traps: Structural traps such as anticlines, roll-over structures, diapirs and faults, slumps, gravitational and compactional traps; stratigraphic traps such as lateral facies changes, pinchout, unconformities, reefs, channels, turbidites;HC Accumulation and Preservation: Timing of trap formation, maturation and HC migration, burial history and critical moment, dynamics of HC accumulation, spill points, HC losses and degradation, interpretation of HC system charts;Basin Modeling: Concept of modeling thermal and subsidence history of a basin;Outline of Unconventional Resources: CBM and ECBM, tight oil and gas, shale oil and gas;Production: water drive, gas cap drive, dissolved gas drive, artificial lift and enhanced recovery, production wells.

GLP5941: GEOPHYSICS, SEISMIC ACQUISITION AND PROCESSING

Code: **GLP5941**
NQF level: 9
Contact hours: 28 h lectures and 21 h practical.
Credits: 12
Course assessment: **Continuous 50%**: A minimum of 1 written test, 2 assignments, and 1 seminar presentation
Examination 50%: One 2 hour exam paper.
Course description: Common Geophysical Exploration Methods: Gravimetry, magnetic, magneto-telluric; principles of physics, applications and limitations; combination of methods; Interpretation of Common Methods: Delineation of gross basin architecture, faults, basement highs and lows, recognitions of diapers and intrusive bodies; Seismic Acquisition: Principles of physics, seismic ray paths, seismic anisotropy, parameters controlling reflection and transmission, set-up of onshore and offshore seismic surveys, survey geometries, CDP surveys, parameters controlling resolution and survey depths; Seismic Data Processing: Selection of optimum processing parameters, velocity analysis, NMO correction, CMP stacking, deconvolution, removal of multiple reflectors, reflector enhancement, migration, tuning, depth conversion, attribute analysis.

GLP5961: PETROPHYSICS

Code: **GLP5961**
NQF level: 9
Contact hours: 28 h lectures and 21 h practical.
Credits: 12
Course assessment: **Continuous 50%**: A minimum of 1 written test, 2 assignments, and 1 seminar presentation
Examination 50%: One 2 hour exam paper.
Course description: Physical parameters of rocks: Density, compressibility, elasticity, sonic velocity, porosity, permeability, capillary pressure, electric resistivity, radioactivity; Borehole geophysics: Mechanical, radioactive, sonic, density, neutron, electric, NMR, and image logging methods: their principles, applications and limitations; interpretations in terms of lithofacies, porosity, permeability, density, pore fluid, pore gas, and acoustic impedance; Evaluation of geological data: Formation evaluation with seismic attributes and geophysical well log evaluation; Integration of seismic and well data: Seismic to well ties, synthetic seismograms; Reservoir Physics: Reservoir pressures, fluid dynamics, pressure – temperature relationships.

GLP5902: SEQUENCE STRATIGRAPHY AND STRATIGRAPHIC FORWARD MODELLING

Code: **GLP5902**
NQF level: 9
Contact hours: 28 h lectures and 21 h practical.
Credits: 12
Course assessment: **Continuous 50%**: A minimum of 1 written test, 2 assignments, and 1 seminar presentation
Examination 50%: One 2 hour exam paper.
Course description: Seismic Stratigraphy: Seismic reflections, seismic facies, terminology in seismic stratigraphy;
Seal level changes: Eustatic and relative sea level fluctuations, accommodation, combined subsidence and sea level curves, hierarchy of stratigraphic elements;Sequence Stratigraphy: Cycles, parasequences as sequence building blocks, parasequence stacking patterns and sets, system tracts, types of sequence boundaries, key surfaces, Wheeler diagrams, genetic sequence stratigraphy; application to tectonically active basins;Applied Sequence Stratigraphy: Application on seismic, core and wireline data sets, examples for carbonate and siliciclastic sequences, exploration significance;
Stratigraphic Forward Modeling: Subsurface prediction with SFM, applications and limitations; examples of clinoform, carbonate platform and turbidite models; Reservoir Characterisation: Reservoir quality and continuity.

GLP5912: SUBSURFACE GEOLOGY AND SEISMIC INTERPRETATION

Code: **GLP5912**
NQF level: 9
Contact hours: 98 h combined lectures and practical.
Credits: 24
Course assessment: **Continuous 50%**: A minimum of 1 written test, 3 assignments, and 1 seminar presentation
Examination 50%: One 3 hour exam paper.
Course description: Wavelet Analysis and Seismic Stratigraphy: Petrophysics and velocity models, phase and polarity conventions, diffractions and migrations, velocity pull up/pull down, gas effect, fluid substitution, review on seismic stratigraphy, seismic facies analysis and paleoenvironmental interpretation;Geological structures and their seismic expression: Termination patterns, clinoforms, anticlines, folds, roll-over, slumps, faults, growth-faults, thrusts, toe-trusts, diapirs, channels, turbidite fans, carbonate buildups, seaward dipping reflectors and other features of volcanic margins;
Petrel and PetroMod: Surfaces and input data, seismic to well tie, stratigraphic modeling, structural and fault analysis, fracture modeling, maturity modeling;Evaluation of geological data: Formation evaluation and well log evaluation.

GLP5942: SEDIMENTARY PETROGRAPHY AND ORGANIC GEOCHEMISTRY

Code: **GLP5942**
NQF level: 9
Contact hours: 28 h lectures and 21 h practical.
Credits: 12
Course assessment: **Continuous 50%**: A minimum of 1 written test, 2 assignments, and 1 seminar presentation
Examination 50%: One 2 hour exam paper.
Course description: Source Rock Petrography: Lithologies, macroscopic description and classification, trace and body fossils, maceral analyses, vitrinite reflectance, pyrite framboide microscopy, fluorescence microscopy, radioactivity, stable isotopes,;
Reservoir Rock Petrography: Lithologies, macroscopic description and classification, thin section petrography, texture analysis, cementation, fracturing, dissolution, dolomitisation, primary and secondary porosity/permeability, wettability;
Seal Rock Petrography: Lithologies, macroscopic description and classification, thin section petrography, texture analysis, porosity and permeability;Organic chemistry of source rocks: Proximate and elemental analysis, rock eval pyrolysis, biomarkers, source - oil correlation;Chemistry of hydrocarbons: Organic constituents, API grades, trace elements, gaschromatography.

GLP5962: RESERVOIR GEOLOGY AND PROSPECT ANALYSIS

Code: **GLP5962**
NQF level: 9
Contact hours: 28 h lectures and 21 h practical.
Credits: 12
Course assessment: **Continuous 100%**: The continuous assessment (CA) comprises a major assessment based on the 'virtual oil company' group project and a seminar presentation.
Course description: Petroleum Resource Assessment: Basin analogues, volumetric yield, geochemical material balance, play assessment, discovery process modelling;Reserve Calculations: Preliminary and post-discovery reserve calculations;
Risking Petroleum Resources: risks and uncertainties, risks assessments, risk models, probability concept, risk levels;Lead and Prospect Evaluation: prospect identification, levels of prospect understanding, Monte Carlo Simulation; petroleum resource classification systems; Group Exercise "Virtual Oil Company": Exercise in groups of 3-6 students to produce a complete Petroleum Resource Assessment based on real data. The exercise is for the duration of 5 weeks.

GLP5990: FIELD TRIP – ONSHORE ANALOGUES

Code: **GLP5990**
NQF level: 9
Contact hours: Two to three weeks excursion and field work.
Credits: 12
Course assessment: **Continuous 100%**: Assesment comprises day reports during field trips, a seminar presentation, and a final report.
Course description: Lithology: source, reservoir and seal lithologies, weathered and fresh lithologies and their assessment regarding porosity, permeability, OM content;
Facies: recognition of 3D facies architectures and interpretation of depositional environments, focus on passive continental volcanic margins; Stratigraphic Surveying: procedures for measuring and documenting sedimentary, stratigraphic, gamma ray, and magnetic logs; Sampling: sampling for porosity and permeability evaluation, source rock sampling, geochemical sampling.

SECOND YEAR COURSES

GLP5999: INDUSTRY INTERNSHIP

Code: **GLP5999**
NQF level: 9
Contact hours: Face to face consultations with supervising lecturer and/or coordinating lecturer on a regular basis.
Credits: 12
Course assessment: **Continuous 100%**: Assesment comprises daily field/lab logbook (30%), company assessment (10%), lecturer assessment (10%), final report (30%), and seminar presentation (20%).
Course description: During Industrial Internship, students will conduct project work under company supervision in areas of petroleum exploration and/or production. The internship duration should be for a minimum of three months. Ideally the internship is related to the MSc thesis.

GLP5900: MASTER THESIS

Code:	**GLP5900**
NQF level:	9
Contact hours:	Face to face consultations with supervising lecturer and/or coordinating lecturer on a regular basis.
Credits:	120
Course assessment:	The assessment is based on: **(i) research report (70%)**, **(ii) presentation (15%)** based on the research report, and **(iii) an oral examination (15%)**.

Course description: Research proposal: Preparation of research proposal according to recommended UNAM guidelines based on a selected research topic in consultation with project supervisors; submission of proposal to relevant postgraduate study committees for approval; Research project: Conducting research, including desk study, field work, sampling and data collection, sample and data analysis, data interpretation; Research thesis: Writing of thesis in accordance with recommended UNAM guidelines; Examination: Internal and external examination of thesis.

G.7. MSC AND PHD GEOLOGY PROGRAMMES BY THESIS – 11MASC AND 11DPSC

The geology department offers a 2 year MSc (by thesis only) – 11MASC and a 3 year Doctor in Philosophy (PhD) – 11DPSC. Interested candidates shall inquire with the geoplogy department for MSc and PhD projects.

G.7.1. REGULATIONS

Regulations are given in the 2022 prospectus of the School of Postraduate Studies.

H. DEPARTMENT OF PHYSICS, CHEMISTRY & MATERIAL SCIENCE

H.1. DEPARTMENTAL REGULATIONS

To register for a BSc. in Physics Honours, a candidate needs to have obtained at least a **C-symbol** in both NSSC **Mathematics and NSSC Physical Science** (or equivalent qualifications). **English** is a **compulsory** subject and should normally have been obtained as a Second Language at NSSC (O level) with a minimum C symbol or English as a First Language at NSSC (O level) with a minimum D symbol. A candidate should obtain a minimum of 25 points on the UNAM Evaluation Point Scale in his/her five (5) best subjects (of which Physics, Mathematics and English must be included) to be admitted to undergraduate studies (Refer to the **General Admission Criteria f**or **Undergraduate Programmes** in the **General Inf**or**mation and Regulations Yearbook**). Obtaining the minimum number of points, however, **does not necessarily ensure admission.** Admission is based on places available in courses, subjects and programmes and is awarded based on merit.

To register for Bachelor of Science in Chemistry (Honours) degree programme a candidate must hold a valid Namibian Senior Secondary Certificate (NSSC) (ordinary or higher) or a recognised equivalent qualification. English is a compulsory subject and should normally have been obtained as a Second Language at NSSC (O level) with a minimum **C symbol** or English as a First Language at NSSC (O level) with a minimum D symbol. In addition at least a **C symbol** on NSSC or equivalent qualification in **Mathematics and Physical Science** is required. A candidate should obtain a minimum of 25 points on the UNAM Evaluation Point Scale in his/her five (5) best subjects (of which **Mathematics, English, Physical Science** must be included) to be admitted to undergraduate studies (Refer to the General Admission Criteria for Undergraduate Programmes in the General Information and Regulations Yearbook). Obtaining the minimum number of points, however, does not necessarily ensure admission. Admission is based on availability of places and is awarded on the basis of merit.
The Faculty reserves the right to subject candidates to additional selection procedures before admission. Admission can also be considered for persons who qualify through the **Mature Age Entry Scheme** upon successful completion of the relevant examinations as set out in the General Regulations (in the General Information and Regulations Yearbook). A special application form is available for this purpose. Such candidates may also be required to pass a Faculty entry test before admission is considered.

H.1.1. DURATION OF STUDY

A student should be able to complete this programme in a minimum of four (4) years.

H.1.2. ASSESSMENT CRITERIA

All practical sessions are compulsory. Tutorial sessions are compulsory in the courses where they are offered. To qualify for the supplementary examination, the student needs a final mark of between **45 – 49%**, and a subminimum of **40%** examination mark. The final mark is composed of **50%** continuous assessment mark and **50%** examination mark. In their final year, all students are required to do a research project. Continuous assessment will consist of a subset of the following, depending on the course needs: class tests, reports (practical-, project-, research-, etc.) and assignments.

H.1.3. MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE DEPARTMENT/FACULTY

To be re-admitted into the faculty for a year of registration, a student must have passed the minimum number of courses as indicated below:

For Physics programmes:

- **4** courses (equivalent to **64** credits) by the end of the first year; **2** of these courses (equivalent to **32 credits**) must be non-core,
- **8** courses (equivalent to **144** credits) by the end of the **second year**,
- **15** courses (equivalent to **240** credits by the end of the **third year**, and
- **23** courses (equivalent to **368** credits) by the end of the **fourth year**.

For Chemistry and Material Science programmes:

- **64** credits of total **160** credits by the end of the first year (about 40%); 2 of these courses (equivalent to **32** credits) must be **non-core**
- **8** full courses (equivalent to **128** credits of **288** cumulative credits) by the end of the **second year** (about 45%)
- **15** full courses (equivalent to **240** credits of **424** cumulative credits) by the end of the **third year** (about 57%)
- **24** full courses (equivalent to **384** credits of **544** cumulative credits) by the end of the **fourth year** (about 69%)

H.1.4. ADVANCEMENT AND PROGRESSION RULES

A student advances to when at least **2/3** of the courses of the curriculum for a specific year have been passed. If a student passed only 1/3 of the full curriculum of a specific year, he/she may not register for any courses of the following year. In all cases, prerequisites for courses must be passed before a student can proceed to register for such courses.

For Physics programmes:

- From year **1** to **2**: At least **7** courses (equivalent to **112** credits) prescribed for year **1**.
- From year **2** to **3**: All **first-year** courses plus at least **6** courses (equivalent to **96** credits) prescribed for year **2**.
- From year **3** to **4**: All **second-year** courses plus at least **5** courses (equivalent to **80** credits) prescribed for year **3.**

For Chemistry programmes:

- **From year 1 to year 2:** At least **7** full courses (equivalent to **112** credits of **160** credits at level **5**) prescribed for year **1**.
- **From year 2 to year 3:** All first year courses plus at least **5** full courses (equivalent to **80** credits of **128** credits at level **6**).

- **From year 3 to year 4:** All second year courses plus at least **5** full courses (equivalent to **80** credits of **128** credits at level **7**).

H.1.5. MAXIMUM NUMBER OF COURSES THAT MAY BE TAKEN PER YEAR

A student may not take more than the equivalent of **12** full courses per year.

H.1.6. REQUIREMENTS FOR AWARD OF QUALIFICATION

This qualification will be awarded to candidates credited with a minimum of 544 credits (out of which 48 are from UNAM core courses, 376—384 are from physics, chemistry and material science courses and prescribed mathematics courses and 112—120 credits from elective courses from other subjects (the actual numbers depending on the stream chosen).

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H.1.7. PHYSICS PROGRAMME, CURRICULUM & PREREQUISITES

Four elective "streams" are possible: Stream A1 that combines **Mathematics** and **Computer Science** electives with a **Mathematics** slant, Stream A2 that combines **Mathematics** and **Computer Science** electives with a **Computer Science** slant and Stream C that allows **Chemistry** electives. No new registrations for Stream B that allows **Geology** Electives will be accepted for 2022.

H.1.8.1. QUALIFICATION: Bachelor of Science in Physics Honours

Students opting for **Stream A1 (Mathematics slant)** must take all the following courses **(11BPHY)**

YEAR 1

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Year 1 Semester 1					
LCE3419	English Comunication & Study Skills	8	16		None
CLC3509	Computer Literacy	8	8		None
MAT3511	Basic Mathematics	8	16		None
MAT3501	Analytic Geometry	8	8		None
MAT3521	Matrices & Complex Numbers	8	8		None
PHY3511	Physics for Physical Sciences I	8	16		None
CMP3511	Programming Fundamentals I	8	16		None
Year 1 Semester 2					
LEA3519	English for Academic Purposes	8	16		None
CSI3580	Contemporary Social Issues	8	8		None
MAT3512	Precalculus	8	16		None
PHY3512	Physics for Physical Sciences II	8	16		PHY3511
CMP3512	Programming Fundamentals II	8	16		CMP3511
Total Credits			**160**		

YEAR 2

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Year 2 Semester 1					
PHY3651	Mechanics & Waves	8	16	PHY3511, MAT3512	None
PHY3601	Optics	8	8	PHY3512, MAT3512	None
MAT3611	Calculus I	8	16	MAT3512	None
MAT3661	Sets and Logic	8	8	MAT3511	None
MAT3641	Numerical Methods with MATLAB	8	8	MAT3521	None
COS3611	Object Orientated Programming I	8	16	CMP3512	None
Year 2 Semester 2					
PHY3612	Electromagnetism	8	16	PHY3512, MAT3512	None
PHY3622	Electronics	8	8	PHY3512, MAT3512	None
MAT3612	Calculus II	8	16	MAT3512	None
MAT3642	Ordinary Differential Equations	8	8	MAT3521, MAT3512	None
MAT3652	Elementary Linear Algebra	8	16	(MAT3511 **or** MAT3512), MAT3521	None
Total Credits			**136**		

YEAR 3

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Year 3 Semester 1					
PHY3711	Electrodynamics	7	16	PHY3612, MAT3612	None
PHY3701	Thermodynamics & Kinetic Theory	7	8	PHY3651, MAT3612	None
PHY3741	Computational Physics	7	8	CMP3511 or CMP3512 or MAT3641	None
MAT3731	Real Analysis I	7	16	MAT3611, MAT3612	None
MAT3711 **OR** MAT3701 & MAT3781	Linear Algebra I **OR** Numerical Analysis & Elements of Set Theory	7 **or** 7	16	(MAT3611 **or** MAT3612), MAT3661, MAT3652 **OR** (MAT3611 **or** MAT3612), MAT3641, MAT3661	None
Year 3 Semester 2					
PHY3742	Analytical Mechanics	7	8	PHY3651, MAT3612	None
PHY3752	Modern Physics	7	16	PHY3651 **or** PHY3612	None
PHY3722	Research Methodology	7	8	Any **2**: PHY3651, PHY3612 **or** (PHY3601 **&** PHY3622)	None
MAT3752 **OR** MAT3732 **OR** MAT3712	Partial Differential Equations **OR** Real Analysis II **OR** Linear Algebra II	7 **or** 7 **or** 7	16	(MAT3611 **or** MAT3612) and MAT3642 **OR** MAT3611 **or** MAT3612 **OR** (MAT3611 **or** MAT3612), MAT3661, MAT3652	None
MAT3742	Vector Analysis		8	MAT3611 or MAT3612	None
Total Credits			**120**		

YEAR 4

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Year 4 Semester 1					
PHY3811	Quantum Mechanics	8	16	PHY3742, PHY3752	None
PHY3831	Statistical Mechanics	8	16	PHY3651, PHY3701	None
PHY3809	Advanced Electrodynamics	8	8	PHY3711	None
PHY3821	Plasma Physics	8	8	PHY3711	None
Year 4 Semester 2					
PHY3812	Solid State Physics	8	16	PHY3701, PHY3752	None
PHY3802	Nuclear Physics	8	8	PHY3752 or PHE3751	None
PHY3822	Optics & Laser Physics	8	8	PHY3601, PHY3651, PHY3711	None
PHY3842	Astrophysics	8	8	PHY3752	None
REP3802	Aspects of Renewable Energy Physics	8	8	PHY3701, PHY3752	None
PHY3810	Research Project	8	**32**	**All** 3rd-year courses	None
Total Credits			**128**		

H.1.8.2. BACHELOR OF SCIENCE IN PHYSICS HONOURS

Students opting for **Stream A2 (Computer Science slant)** must take all the following courses **(11BPCO)**

YEAR 1

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Year 1 Semester 1					
LCE3419	English Comunication & Study Skills	4	16		None
CLC3509	Computer Literacy	5	8		None
MAT3511	Basic Mathematics	5	16		None
MAT3501	Analytic Geometry	5	8		None
MAT3521	Matrices & Complex Numbers	5	8		None
PHY3511	Physics for Physical Sciences I	5	16		None
CMP3511	Programming Fundamentals I	5	16		None
Year 1 Semester 2					
LEA3519	English for Academic Purposes	5	16		None
CSI3580	Contemporary Social Issues	5	8		None
MAT3512	Precalculus	5	16		None
PHY3512	Physics for Physical Sciences II	5	16		PHY3511
CMP3512	Programming Fundamentals II	5	16		CMP3511
Total Credits			**160**		

YEAR 2

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Year 2 Semester 1					
PHY3651	Mechanics & Waves	6	16	PHY3511, MAT3512	None
PHY3601	Optics	6	8	PHY3512, MAT3512	None
MAT3611	Calculus I	6	16	MAT3512	None
MAT3661	Sets and Logic	6	8	MAT3511	None
COS3611	Object Orientated Programming I	6	16	CMP3512	None
Year 2 Semester 2					
PHY3612	Electromagnetism	6	16	PHY3512, MAT3512	None
PHY3622	Electronics	6	8	PHY3512, MAT3512	None
MAT3612	Calculus II	6	16	MAT3512	None
MAT3642	Ordinary Differential Equations	6	8	MAT3521, MAT3512	None
MAT3652	Elementary Linear Algebra	6	16	(MAT3511 **or** MAT3512), MAT3521	None
COS3612	Object Orientated Programming II	6	16	CMP3511, CMP3512	COS3611
Total Credits			**144**		

YEAR 3

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Year 3 Semester 2					
PHY3711	Electrodynamics	7	16	PHY3612, MAT3612	None
PHY3701	Thermodynamics & Kinetic Theory	7	8	PHY3651, MAT3612	None
PHY3741	Computational Physics	7	8	CMP3511 or CMP3512 or MAT3641	None
MAT3711 **OR** MAT3731	Linear Algebra I **OR** Real Analysis I	7 **OR** 7	16	(MAT3611 **or** MAT3612), MAT3661, MAT3652 **OR** MAT3611, MAT3612	None
CMP3731	Software Engineering		16	COS3612	None
Year 3 Semester 2					
PHY3742	Analytical Mechanics	7	8	PHY3651, MAT3612	None
PHY3752	Modern Physics	7	16	PHY(3651 or PHY3612)	None
PHY3722	Research Methodology	7	8	Any **2:** PHY3651, PHY3612 **or** (PHY3601 **&** PHY3622)	None
COS3712 **OR** MAT3712 **OR** MAT3732	Human Computer Interaction **OR** Linear Algebra II **OR** Real Analysis II	7 **OR** 7 **OR** 7	16	COS3612 **OR** (MAT3611 **or** MAT3612), MAT3661, MAT3652 **OR** MAT3611 **or** MAT3612	CMP3731 **or** None **or** None
Total Credits			**112**		

YEAR 4

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Year 4 Semester 1					
PHY3811	Quantum Mechanics	8	16	PHY3742, PHY3752	None
PHY3831	Statistical Mechanics	8	16	PHY3651, PHY3701	None
PHY3809	Advanced Electrodynamics	8	8	PHY3711	None
PHY3821	Plasma Physics	8	8	PHY3711	None
Year 4 Semester 2					
PHY3812	Solid State Physics	8	16	PHY3701, PHY3752	None
PHY3802	Nuclear Physics	8	8	PHY3752 or PHE3751	None
PHY3822	Optics & Laser Physics	8	8	PHY3601, PHY3651, PHY3711	None
PHY3842	Astrophysics	8	8	PHY3752	None
REP3802	Aspects of Renewable Energy Physics	8	8	PHY3701, PHY3752	None
PHY3810	Research Project	8	**32**	**All** 3rd-year courses	None
Total Credits			**128**		

H.1.8.3. BACHELOR OF SCIENCE IN PHYSICS HONOURS

Students opting for **Stream C (Chemistry Electives)** must take all the following courses **(11BPCH)**

YEAR 1

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Year 1 Semester 1					
LCE3419	English Comunication & Study Skills	4	16		None
CLC3509	Computer Literacy	5	8		None
MAT3511	Basic Mathematics	5	16		None
MAT3501	Analytic Geometry	5	8		None
MAT3521	Matrices & Complex Numbers	5	8		None
PHY3511	Physics for Physical Sciences I	5	16		None
CHM3511	Chemistry 1A	5	16		None
Year 1 Semester 2					
LEA3519	English for Academic Purposes	5	16		None
CSI3580	Contemporary Social Issues	5	8		None
MAT3512	Precalculus	5	16		None
PHY3512	Physics for Physical Sciences II	5	16		PHY3511
CHM3512	Chemistry 1B	5	16		None
Total Credits			**160**		

YEAR 2

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Year 2 Semester 1					
PHY3651	Mechanics & Waves	6	16	PHY3511, MAT3512	None
PHY3601	Optics	6	8	PHY3512, MAT3512	None
MAT3611	Calculus I	6	16	MAT3512	None
MAT3661	Sets and Logic	6	8	MAT3511	None
CHM3611	Inorganic Chemistry I	6	16	CHM3511, CHM3512	None
CHM3631	Physical Chemistry I	6	16	CHM3511, CHM3512, MAT3511, MAT3512	None
Year 2 Semester 2					
PHY3612	Electromagnetism	6	16	PHY3512, MAT3512	None
PHY3622	Electronics	6	8	PHY3512, MAT3512	None
MAT3612	Calculus II	6	16	MAT3512	None
MAT3642	Ordinary Differential Equations	6	8	MAT3521, MAT3512	None
MAT3652	Elementary Linear Algebra	6	16	(MAT3511 **or** MAT3512), MAT3521	None
Total Credits			**144**		

YEAR 3

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Year 3 Semester 1					
PHY3711	Electrodynamics	7	16	PHY3612, MAT3612	
PHY3701	Thermodynamics & Kinetic Theory	7	8	PHY3651, MAT3612	
MAT3731 **OR** MAT3711	Real Analysis I **OR** Linear Algebra I	7 **OR** 7	16	MAT3611, MAT3612 **OR** (MAT3611 **or** MAT3612), MAT3661, MAT3652	None
CHM3751	Inorganic Chemistry II	7	16	CHM3611, MAT3512	
Year 3 Semester 2					
PHY3742	Analytical Mechanics	7	16	PHY3651, MAT3612	
PHY3752	Modern Physics	7	16	PHY(3651 or PHY3612)	
PHY3722	Research Methodology	7	8	Any **2**: PHY3651, PHY3612 **or** (PHY3601 **&** PHY3622)	
CHM3712	Physical Chemistry II	7	16	CHM 3631, MAT3611	
Total Credits			**112**		

YEAR 4

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Year 4 Semester 1					
PHY3811	Quantum Mechanics	8	16	PHY3742, PHY3752	
PHY3831	Statistical Mechanics	8	16	PHY3651, PHY3701	
PHY3809	Advanced Electrodynamics	8	8	PHY3711	
PHY3821	Plasma Physics	8	8	PHY3711	
Year 4 Semester 2					
PHY3812	Solid State Physics	8	16	PHY3701, PHY3752	
PHY3802	Nuclear Physics	8	8	PHY3752 or PHE3751	
PHY3822	Optics & Laser Physics	8	8	PHY3601, PHY3651, PHY3711	
PHY3842	Astrophysics	8	8	PHY3752	
REP3802	Aspects of Renewable Energy Physics	8	8	PHY3701, PHY3752	None
PHY3810	Research Project	8	**32**	**All** 3rd-year courses	
Total Credits			**128**		

H.1.8.4. Bachelor of Science in Physics Honours Articulation

Students registering for the Physics articulation programme **(11BSPA)** must take all the following courses:

YEAR 1 – 11BSPA

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Semester 1					
PHY3811	Quantum Mechanics	8	16	None	None
PHY3831	Statistical Mechanics	8	16	None	None
PHY3809	Advanced Electrodynamics	8	8	None	None
PHY3821	Plasma Physics	8	8	None	None
Semester 1					
PHY3812	Solid State Physics	8	16	None	None
PHY3802	Nuclear Physics	8	8	None	None
PHY3822	Optics & Laser Physics	8	8	None	None
PHY3842	Astrophysics	8	8	None	None
REP3802	Aspects of Renewable Energy Physics	8	8	PHY3701, PHY3752	None
PHY3880	Research Methodology & Project	8	38	None	None
Total Credits			**134**		

H.1.9. PHYSICS SERVICE COURSES

CODE	COURSE	NQF LEVEL	CREDIT	PREREQUISITES	COREQUISITES
Semester 1					
PHY3501	Physics for Life Sciences I	5	8	None	None
PHE3751	Modern Physics for Educators	7	16	PHY3511, PHY3512, MAT3511, MAT3512	None
Year 4 Semester 1					
PHY3402	Physics for Radiographers	4	8		None
PHY3532	Physics for Life Sciences II	5	16	None	PHY3501
PHE3642	Electricity and Magnetism	6	8	PHY3512, MAT3511, MAT3512	None
Total Credit			**56**		

H.1.10. PHYSICS CURRICULUM COURSE DESCRIPTIONS

FIRST YEAR COURSES

PHY3511: PHYSICS FOR PHYSICAL SCIENCES I

Course title: **PHYSICS FOR PHYSICAL SCIENCES I**
Code: **PHY3511**
NQF level: 5
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Course assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous Assessment will consist of three (3) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites: NSSC Physical Science and Mathematics (C-symbols)
Co-requisites: None

Course description: Units, significant figures & scientific notation; vectors: properties, components, unit vectors, products; average & instantaneous speed, velocity and acceleration; one dimensional motion with constant acceleration; falling bodies; two dimensional motion with constant acceleration; projectile motion; uniform circular motion; circular motion; relative velocity and acceleration; Newton's laws; inertial frames; weight; friction; applications; work and kinetic energy; power; conservative and non-conservative forces; gravitational potential energy; conservation theorem; work-energy theorem; linear momentum & impulse; conservation of linear momentum - 2 particle system; collisions; equilibrium; centre of gravity; applications; Newtonian gravitation; gravitational constant; weight & gravitational force; Kepler's laws; pressure; Archimedes' principle; laminar flow; Bernoulli's equation; temperature & temperature scales; thermal expansion; ideal gas; heat; heat capacity; latent heat; heat transfer.

PHY3501: PHYSICS FOR LIFE SCIENCES I

Course title: **PHYSICS FOR LIFE SCIENCES I**
Code: **PHY3501**
NQF level: 5
Contact hours: 28 Lectures and 14 Practical Sessions/Tutorials
Credits: 8
Course assessment: Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**)
Continuous Assessment will consist of two (2) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites: None
Co-requisites: None

Course description: This course is to introduce Life science students to physics concepts and applications that will be useful to them in their undergraduate studies and carrier. The course is not for physical science students as it is not equivalent to PHY3511.Units and unit conversion, SI-unit system and non-metric systems, significant figures and scientific notation; Vectors and scalars, operations with vectors in two dimensions, component method of vector operations; Average velocity; acceleration; motion at constant acceleration; freely falling bodies; Projectiles; uniform circular motion; Force and weight, Newton's first, second and third laws, applications of Newton's laws, free-body diagrams, friction, motion on inclined planes; centripetal force, banking of curves; Newton's law of universal gravitation; gravity near the Earth's surface, satellites; Kepler's first, second and third laws; Work done by a constant force, kinetic energy, work-energy theorem, potential energy, conservation of mechanical energy, power; Conservation of momentum; collisions in one dimension; impulse; conservation of energy and momentum in collisions; elastic and inelastic collisions in one dimension.

PHY3512: PHYSICS FOR PHYSICAL SCIENCES II

Course Title: PHYSICS FOR PHYSICAL SCIENCES II
Code: PHY3512
NQF Level: 5
Contact Hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Course assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous Assessment will consist of three (3) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites: None
Co-requisites: PHY3511: Physics for Physical Sciences I

Course description: This course introduces the phenomena associated with electrostatics (charges at rest) and magnetostatics (the magnetic effects associated with steady currents). It also introduces and develops the use of the electric and magnetic field vectors and relates them by considering electromagnetic induction at a classical level. The connection between these fields and conventional circuit parameters R, C and L is developed, together with the techniques to deal with elementary transient phenomena. Sound, basic geometrical optics and radioactivity and its detection are also covered. The contents of this course include: Electric charge; insulators and conductors; Electric force and coulomb's law, Electric field and Gauss's law; Electric potential; Capacitance and capacitors; Direct current; Ohm's law and simple circuits; Magnetic field; Alternating current; Transformers; Phenomenological approach to RL and RC circuits; Basic geometrical optics; Radioactivity and its detection; Sound.

PHY3532: PHYSICS FOR LIFE SCIENCES II

Course Title: **PHYSICS FOR LIFE SCIENCES II**
Code: **PHY3532**
NQF Level: 5
Contact Hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Course assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous Assessment will consist of three (3) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites: None
Co-requisites: PHY3501: Physics for Life Sciences I

Course description: This course introduces life science students to concepts of physics and their application to real life situations, new topics that were not dealt with in PHY 3501 are introduced (i.e., on electricity, magnetism and radioactivity). The course is not for physical science students as it is not equivalent to PHY3512. The content of this course is good enough to help the life science students throughout their undergraduate work and careers. The following topics will also be covered: Electric charge; insulators and conductors; Electric force and coulomb's law , Electric field and Gauss's law; Electric potential; Capacitance and capacitors; Direct current; Ohm's law and simple circuits; Magnetic field; Alternating current; Transformers; Phenomenological approach to RL and RC circuits; Temperature, gas and thermal expansion; Basic geometrical optics; Radioactivity and its detection.

PHY3402: PHYSICS FOR RADIOGRAPHERS

Course Title: **PHYSICS FOR RADIOGRAPHERS**
Code: **PHY3402**
NQF Level: 4
Contact Hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course assessment: Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**)
Continuous Assessment will consist of two (2) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites: None
Co-requisites: None

Course Description: Electromagnetic radiation; elementary quantum theory ; atomic structure; atomic nucleus; radioactive decay - half-life, law of radioactive decay, activity of a radioactive sample; detectors of radioactive particles; X- and Gamma-rays and their interactions with matter – photo-absorption, Compton scattering, pair-production; homogeneous and heterogeneous beams, x-ray spectra; intensity of x- and gamma-radiation as a function of distance to the source and as a function of the thickness of the absorber; attenuation coefficients; half-value layer; filters; effects of the different absorption modes on the clarity and quality of a radiographic image; dosimetry - absorbed dose; exposure; dosimetric devices; maximum permissible doses.

SECOND YEAR COURSES

PHY3651: MECHANICS & WAVES

Course title: **MECHANICS & WAVES**
Code: **PHY3651**
NQF level: 6
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Course assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous Assessment will consist of three (3) class tests, at least two (2) assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites: PHY3511: Physics for Physical Sciences I and MAT3512: Precalculus
Co-requisites: None

Course description: Vectors, vector operations and the calculus of vectors. Rectilinear and curvilinear motion; Circular motion; Translational & rotational uniform relative motion; Mass; Linear momentum; Newton's Laws; Friction; The linear and quadratic laws of fluid drag; Variable mass systems; Angular momentum; Central forces; Work energy and power; Conservation laws; Rectilinear motion under conservative forces; Non-conservative forces; Centre of mass; Motion of the centre of mass. Linear and angular momentum of a system; Kinetic energy of a system; Conservation laws of a system; Transforming between Laboratory and Centre-of-mass Frames; Reduced mass; Collision Theory; Rutherford scattering; Angular momentum of a rigid body; Moments and products of inertia; Equation of motion for a rotating body; Kinetic energy of rotation; Body on a spring; Classical SHM; Damped SHM; Forced motion; The different kinds of waves; Standing waves on a string; The one dimensional wave equation; Travelling waves: properties; Plane waves; Scalar & vector waves; Reflection and transmission.

PHY3601: OPTICS

Course Title: **OPTICS**
Code: **PHY3601**
NQF Level: 6
Contact Hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course assessment: Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**)
Continuous Assessment will consist of two (2) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites: PHY3512: Physics for physical sciences II and MAT3512: Precalculus
Co-requisites: None

Course description: Huygens's principle and Fermat's principle; Reflection and refraction of plane waves; Reflection and refraction of waves at plane and spherical surfaces; Lens, prisms, dispersion and chromatic aberrations; Introduction to interference and diffraction and polarization;

PHY3612: ELECTROMAGNETISM

Course Title: **ELECTROMAGNETISM**
Code: **PHY3612**
NQF Level: 6
Credits: 16
Contact Time: 56 Lectures and 14 Practical Sessions/Tutorials
Course assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous Assessment will consist of three (3) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites: PHY3512: Physics for Physical Sciences II and MAT3512: Precalculus
Co-requisites: None

Model description: This course will provide students with information on how the charges at rest and those in motion behave. This course will be calculus-based and students will develop the skill to obtain different equations and solve related problems. The contents of the course are: Electric interaction; Static electric charge and Gauss's Law; Electric potential; Capacitors; Electric current; Ohm's law; Resistance, Joule effect and emf; Magnetic interaction; Lorentz force; Electromagnetic field of a moving charge; Electric flux of a moving charge; Magnetic field and electric current; Magnetostatics; Ampere's law; Time dependent electric field; Maxwell's equations.

PHY3622: ELECTRONICS

Course Title:	**ELECTRONICS**
Code:	**PHY3622**
NQF Level:	7
Contact hours:	28 Lectures and 7 Practical Sessions/Tutorials
Credits:	8
Course assessment:	Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**) Continuous Assessment will consist of two (2) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites:	PHY3512: Physics for physical sciences II and MAT3512: Precalculus
Co-requisites:	None

Course description: This course introduces the basic concepts of analogue electronics and illustrates its applications through examples using such as diodes, BJT's and FET and operational amplifiers. Introduction to semi-conductor theory, intrinsic, p & n type doping, extrinsic semiconductors, conduction processes; Semiconductors diodes and diodes applications, devices transistors, biasing of transistors, load line and the Q-point and its stability; Small signal equivalent circuits and frequency response; p-n-p-n devices, thyristors, diacs and triacs, IC's, logic operation of integrated circuits; Operational amplifier characteristics, Op-amps practical applications, electronic control circuits and feedback concept; Digital circuits, analogy circuits, hybrid (digital plus analogue) circuits; Standard logic functions and gates - AND, OR, NOT, NAND, NOR, XOR, XNOR; truth tables; Boolean theorems; laws and rules; truth table; Boolean algebra and simplification of basic logic networks circuits; Basic combinational logic circuits, flip-flops and their applications.

PHE3642: ELECTRICITY AND MAGNETISM

Course title:	**ELECTRICITY AND MAGNETISM**
Code:	**PHE3642**
NQF Level:	6
Contact Time:	28 Lectures and 7 Practical Sessions/Tutorials
Credits:	8
Course assessment:	Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**) Continuous Assessment will consist of two (2) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites:	PHY3512: Physics for physical sciences II, MAT3511: Basic Mathematics and MAT3512: Precalculus
Co-requisites:	None

Course description: The content of the course will cover the following: Electric interaction; Static electric charge and Gauss's Law; Electric potential; Capacitors; Electric current; Ohms law; DC circuits; Magnetic field and flux, Lorentz force; Ampere's law; Electromagnetic induction and ac circuits.

THIRD YEAR COURSES

PHY3711: ELECTRODYNAMICS

Course title:	**ELECTRODYNAMICS**
Code:	**PHY3711**
NQF Level:	7
Contact hours:	56 Lectures and 14 Practical Sessions/Tutorials
Credits:	16 NQF credits
Course assessment:	Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**) Continuous Assessment will consist of three (3) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites:	PHY3612: Electromagnetism and MAT3612: Calculus II
Co-requisites:	None

Course description: The following topics are covered in Electrodynamics: Vector analysis, with emphasis on the 'del' operator , integral calculus, curvilinear coordinate systems; The electrostatic field E and its divergence and curl, Gauss's law; The electric potential, Poisson's equation and Laplace's equation; Work and energy in electrostatics, induced charges on conductors and capacitors; Uniqueness theorems and method of images as special techniques for solving some problems; The electric field of a dipole; Electric field in matter – polarization, linear dielectrics, electric displacement; Magnetostatics field B – Lorentz force law, Biot-Savart law, divergence and curl of B, Ampère's law, magnetic vector potential; Magnetic fields in matter – magnetization and the auxiliary field H; Electrodynamics – Ohm's law, Faraday's law, Maxwell's equations in vacuum and in matter, conservation laws, Poynting's theorem.

PHY3701: THERMODYNAMICS AND KINETIC THEORY

Course title:	**THERMODYNAMICS AND KINETIC THEORY**
Code:	**PHY3701**
NQF Level:	7
Contact hours:	28 Lectures and 7 Practical Sessions/Tutorials
Credits:	8
Course assessment:	Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**) Continuous Assessment will consist of two (2) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites:	PHY3651: Mechanics & Waves and MAT3612: Calculus II
Co-requisites:	None

Course description: Fundamental concepts - zeroth law, temperature, equilibrium; equations of state - ideal gas, pressure of an ideal gas, physical basis of temperature; real gases; First Law of Thermodynamics - internal energy, heat, reversible quasi-static processes, work, heat capacity, heat engines; Second Law of Thermodynamics - Caratheodory theorem, absolute temperature, entropy, entropy changes, Clausius inequality, adiabatic equations of ideal gas, Carnot theorem, heat engines; thermodynamic potentials and Maxwell relations - internal energy, enthalpy, Helmholz and Gibbs functions; kinetic theory - mean free path, Maxwell's velocity distribution, Boltzmann distribution; some applications - blackbody radiation, heat capacities of solids.

PHY3741: COMPUTATIONAL PHYSICS

Course title:	**COMPUTATIONAL PHYSICS**
Code:	**PHY3741**
NQF level:	7
Contact hours:	28 Lectures and 7 Practical Sessions/Tutorials
Credits:	8
Course assessment:	Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**) Continuous Assessment will consist of two (2) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark
Pre-requisites:	CMP3511: Programming Fundamentals I or CMP3512: Programming Fundamentals II or MAT3641: Numerical Methods with Matlab
Co-requisites:	None

Course description: A First Numerical Problem: Radioactive decay: numerical approach, program design & construction, program testing; Realistic Projectile Motion: The effect of air resistance; Trajectory of a cannon shell;
Oscillatory Motion: Simple Harmonic Motion; The Pendulum: Adding dissipation, non-linearity and driving forces; Chaos in the driven non-linear pendulum. Random Systems: Random processes; Random walks; Self-avoiding walks; Diffusion;

PHY3742: ANALITICAL MECHANICS

Course title:	**ANALITICAL MECHANICS**
Code:	**PHY3742**
NQF level:	7
Contact hours:	28 Lectures and 7 Practical Sessions/Tutorials
Credits:	16
Course assessment:	Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**) Continuous Assessment will consist of three (3) class tests, at least two (2) assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites:	PHY3651: Mechanics & Waves, MAT3612: Calculus II
Co-requisites:	None

Course description: Lagrangian methods; constraints; generalised coordinates; D'Alembert's principle; Lagrange's equations; moving constraints; Lagrangian; generalised momenta; symmetry and conservation principles; The calculus of variations; minimisation problems; Euler-Lagrange equation; variational & Hamilton's principles; Hamilton's equations; phase space; systems of first order ODEs; Legendre transforms; Hamilton's equations; Hamiltonian phase space; Poisson brackets;

PHE3751: MODERN PHYSICS FOR EDUCATORS

Course title:	**MODERN PHYSICS FOR EDUCATORS**
Code:	**PHE3751**
NQF Level:	7
Contact hours:	56 Lectures and 14 Practical Sessions/Tutorials
Credits:	16
Course assessment:	Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**) Continuous Assessment will consist of three (3) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites:	PHY3511: Physics for Physical sciences I, PHY3512: Physics for Physical sciences II, PHY3611: Classical Mechanics, MAT3511: Basic Mathematics and MAT3512: Precalculus.
Co-requisites:	None

Course description: Blackbody radiation; Planck's quantization; Photoelectric effect; Compton effect; atomic structure; spectral lines of Hydrogen; the nuclear atom; Bohr's theory; correspondence principle; Franck-Hertz experiment; X-rays; de Broglie wavelengths; particle-wave duality; Heisenberg uncertainty relation; Special relativity; departure from Newtonian dynamics; Einstein and Lorentz transformations; Lorentz contraction and time dilation; wave mechanics, Schrödinger equation for a free particle; the potential step. particles in a box ; particle in a finite potential well; Electrons in metals, Nearly free electron model, energy bands; Semiconductors, band gaps, intrinsic carrier concentration, impurity conductivity, donor and acceptor states.

PHY3752 MODERN PHYSICS

Course title:	**MODERN PHYSICS**
Code:	**PHY3752**
NQF Level:	7
Contact hours:	56 Lectures and 14 Practical Sessions/Tutorials
Credits:	16
Course assessment:	Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**) Continuous Assessment will consist of three (3) class tests, at least two (2) tutorial tests/assignments and practical report(s) consolidated to one (1) practical mark.
Pre-requisites:	MAT3612: Calculus II and **either** PHY3651: Mechanics & Waves or PHY3612: Electromagnetism
Co-requisites:	None

Course description: The Birth of Modern Physics: Classical physics of the 1890s, nature of light, the initial atomic theory of matter, problems in 19th-century physics;Special Theory of Relativity: The need for aether, the Michelson-Morley experiment, Einstein's postulates, Lorentz transformation, time dilation and length contraction, addition of velocities, experimental verifications, the twin paradox, space-time and Minkowski diagrams, doppler effect, relativistic momentum, relativistic energy, electromagnetism and relativity, four vectors;Overview of General Relativity : A brief and qualitative descriptive view of: tenets of: General Relativity, tests of General Relativity, gravitational waves, black holes, and frame dragging;Experimental Basis of Quantum Theory: discovery of the X-ray and the Electron, determination of the electron charge, line spectra, blackbody radiation, photoelectric effect, Compton effect;Structure of the Atom: atomic models of Thomson and Rutherford, Rutherford scattering, the classic atomic model, the Bohr Model of the hydrogen atom, successes and failures of the Bohr model, Mosley's law, Franck-Hertz experiment;Wave Properties of Matter and Quantum Mechanics: X-ray scattering, De Broglie waves, electron scattering, particle-wave duality, Heisenberg uncertainty relation, probability, wave functions, the Schrödinger wave equation, expectation values, infinite square-well potential, finite square-well Potential, barriers and tunneling, quantum numbers, Zeeman effect, Lande g factor, spin-orbit interaction;Lasers: stimulated emission, gain and inversion, rate equations, three- and four-level systems, threshold energy, laser applications.

PHY3722: RESEARCH METHODOLOGY

Course title:	**RESEARCH METHODOLOGY**
Code:	**PHY3722**
NQF Level:	7
Contact hours:	28 Lectures only
Credits:	8 NQF credits
Course assessment:	Continuous Assessment **(100%)** only Continuous Assessment will consist of at least three (3) assignments and at least one (1) major report that will produce a practical mark
Pre-requisites:	At least the equivalent of any two full Physics modules at 2nd-year level, i.e. any 2 of PHY3651: Mechanics & Waves, PHY3612: Electromagnetism or **both** PHY3601: Optics **and** PHY3622: Electronics
Co-requisites:	None

Course description: Although the actual topics will be adapted to the students research area the following topics will be "generally" covered in this course: various philosophies of Science; Research Proposals (Guidance to writing good project proposals); Basic research skills (e.g. library research, literature review, article analysis etc.); Research Strategy: Planning, Designing and Implementing; Data collection and interpretation methods; Data Reduction, Error analysis (error propagation); Data analysis; Report writing; Communication, skills required to communicate research findings to a broader audience, presentations (oral & written), peer reviewing, refereed journals; Ethics and Legal Issues (e.g. plagiarism); Basics of Quantitative Research (concerned with the tabulation or numeric relevance of various kinds of behaviour (¨measuring¨); Basics of Qualitative Research (concerned with understanding the processes, which underlie various behavioural patterns (Answering the question ¨why? ¨).

FOURTH YEAR COURSES

PHY3811: QUANTUM MECHANICS

Course title:	**QUANTUM MECHANICS**
Code:	**PHY3811**
NQF Level:	8
Contact hours:	56 Lectures and 14 Practical Sessions/Tutorials
Credits:	16
Course assessment:	Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**) Continuous Assessment will consist of three (3) class tests, at least two (2) assignments and practical report(s) and/or presentation(s) consolidated to one (1) practical mark.
Pre-requisites:	PHY3742: Analytical Mechanics and PHY3752: Modern Physics
Co-requisites:	None

Course description: This course is to have students learn the fundamentals of quantum mechanics. Students will be introduced to many new concepts and techniques in the course. The course will cover the following topics: Mathematical primer; Historical review; The postulates of quantum mechanics, state functions and expectation values, time development of state functions; Dirac notation, eigenvalues and eigenfunctions; Hermitian operators and applications; Commutator relations and compatible observables; Time development of expectation values, Ehrenfest's principle and applications, constants of motion, conservation of energy, momentum and parity; The harmonic oscillator, creation and annihilation operators; Angular momentum, commutation properties of the components of angular momentum, simultaneous eigenfunctions; Total angular momentum, commutation relations for the components of total angular momentum, ladder operators; Elements of matrix mechanics, Pauli spin matrices, spin wave functions; The Slater determinant; Time-independent Perturbation theory, degenerate perturbation theory, the Stark effect; Variational method; Scattering.

PHY3831: STATISTICAL MECHANICS

Course title:	**STATISTICAL MECHANICS**
Code:	**PHY3831**
NQF Level:	8
Contact hours:	56 Lectures and 14 Practical Sessions/Tutorials
Credits:	16
Course assessment:	Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**) Continuous Assessment will consist of three (3) class tests, at least two (2) assignments and practical report(s) and/or presentation(s) consolidated to one (1) practical mark.
Pre-requisites:	PHY3651: Mechanics & Waves and PHY3701: Thermodynamics and Kinetic Theory
Co-requisites:	None

Course description: Macroscopic and microscopic view point of systems,classical and statistical probability;statistics and distribution function, significance of Lagrangian multipliers; the Bose-Einstein statistics, the Fermi-Dirac statistics, the Maxwell-Boltzmann statistics; the Bose-Einstein distribution function, the Fermi-Dirac distribution function, the Maxwell-Boltzmann distribution function;

thermodynamic properties of a system; applications of statistics to gases, monatomic ideal gas;the distribution of molecular velocities, Maxwell-Boltzmann speed distribution, ideal gas in gravitational fields; the principle of equipartition of energy, specific heat capacity of a diatomic gas; applications of quantum statistics to other systems; the Einstein theory of the specific heat capacity of a solid; the Debye theory of the specific heat capacity of a solid; Blackbody radiation, paramagnetism, negative temperatures; the electron gas.

PHY3810: RESEARCH PROJECT

Course title:	**RESEARCH PROJECT**
Code:	**PHY3810**
NQF Level:	8
Contact hours:	At least one (1) contact hour per week with supervisor
Credits:	32
Course assessment:	Continuous Assessment **(100%)** only A typed report of the research in the form of a micro thesi/dissertation must be submitted by the student. This will be evaluated by qualified staff within the field. During the course of the project, the student will also be expected to submit a typed project proposal and orally present the progress of his/her work in the department. Aditionally, the student must either orally present his/her work or produce a poster of his/her work at the annual Faculty of Science Research Conference.
Pre-requisites:	**All** 3rd-year courses completed
Co-requisites:	None

Course description: This one-year course constitutes the research and report writing for an available project within the various fields of physics. The actual content of the course will depend on the topic of research selected by the student, from the available specialized fields within the department. The student will submit a written dissertation (or thesis) of the project upon completion of the research activities.

PHY3809: ADVANCED ELECTRODYNAMICS

Course title:	**ADVANCED ELECTRODYNAMICS**
Code:	**PHY3809**
NQF Level:	8
Contact hours:	28 Lectures and 7 Practical Sessions/Tutorials
Credits:	8 NQF credits
Course assessment:	Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**) Continuous Assessment will consist of two (2) class tests, at least two (2) assignments and practical report(s) and/or presentation(s) consolidated to one (1) practical mark
Pre-requisites:	PHY3711: Electrodynamics
Co-requisites:	None

Course description: This course is a follow-up on the course Electrodynamics and constitute the following topics: Conservation laws in electrodynamics; Vector and scalar potential formulation; Coulomb and Lorentz transformations; Retarded potentials and Jefimenko's equations; Liènard-Wiechert potentials; Electric and magnetic dipole radiation, power radiated; Linear Antennas; Electrodynamics and relativity – relativistic magnetism, field transformation, field tensor.

PHY3821: PLASMA PHYSICS

Course title:	**PLASMA PHYSICS**
Code:	**PHY3821**
NQF level:	8
Contact hours:	28 Lectures and 7 Practical Sessions/Tutorials
Credits:	8
Course assessment:	Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**) Continuous Assessment will consist of two (2) class tests, at least two (2) assignments and practical report(s) and/or presentation(s) consolidated to one (1) practical mark
Pre-requisites:	PHY3711: Electrodynamics
Co-requisites:	None

Course description: Definition and Temperature; Debye shielding; Plasma parameter; Criteria for plasmas; Applications; Uniform **E**- and **B**-fields; Non-uniform **B**-field; Non-uniform **E**-field; Time-varying **E**-field; Time-varying **B**-field; Guiding-centre drifts; Adiabatic invariants; Relation of Plasma Physics to ordinary Electromagnetics; The fluid equation of motion; Fluid drifts perpendicular to **B**; Fluid drifts parallel to **B**; The plasma approximation; Waves; Group velocity; Plasma oscillations; Electron Plasma waves; Sound waves; Ion waves; Plasma approximation; Comparison of ion and electron waves; Electrostatic electron oscillations perpendicular to **B**; Electrostatic ion waves perpendicular to **B**; Lower hybrid frequency; Electromagnetic waves with $\mathbf{B}_0 = 0$; Experimental applications; Electromagnetic waves perpendicular to $\mathbf{B}_0$; Cut-offs and resonances; Electromagnetic waves parallel to $\mathbf{B}_0$; Experimental consequences; Hydromagnetic waves; Magnetosonic waves; The CMA diagram; Diffusion and mobility in weakly ionised gases; Decay of a plasma by diffusion; Steady state solutions; Recombination; Diffusion across a magnetic field; Collisions in fully ionised plasmas; The single-fluid MHD equations; Diffusion in fully ionised plasmas; Solutions to the diffusion equation; Böhm diffusion and neoclassical diffusion;

PHY3812: SOLID STATE PHYSICS

Course title: **SOLID STATE PHYSICS**
Code: **PHY3812**
NQF Level: 8
Contact hours: 56 Lectures and 14 Practical Sessions/Tutorials
Credits: 16
Course assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous Assessment will consist of three (3) class tests, at least two (2) assignments and practical report(s) and/or presentation(s) consolidated to one (1) practical mark.
Pre-requisites: PHY3701: Thermodynamics and Kinetic Theory and PHY3752: Modern Physics
Co-requisites: None
Course description: This course is to have students learn about the properties of solids such as simple crystals, semiconductors and superconductors. The course will cover the following topics: Crystal structure; Fundamental types of lattices, crystal planes; Diffraction of waves by crystals, Bragg law, reciprocal lattice vectors, diffraction conditions, Laue equations, structure factor; Forces between atoms and molecules, forces due to the ionic and covalent bonds, van der Waals forces, dipole-dipole forces; Elastic properties of solids, Young's modulus in terms of inter-atomic force constant, Bulk modulus of an ionic solid, generalized relation between bulk modulus and lattice energy; Lattice dynamics, vibrations of crystals with monatomic basis and with two atoms per primitive basis; Thermal properties, phonon heat capacity, density of states, Einstein model, Debye model, Umklapp processes; Electrons in metals, the free electron Fermi gas, electrical conductivity, Ohm's law, Hall effect; Nearly free electron model, energy bands, Bloch functions, Kronig-penney model; Semiconductors, band gaps, Intrinsic carrier concentration, impurity conductivity, donor and acceptor states; Superconductivity, destruction of superconductivity, Meissner effect, type I and type II superconductors, London equation, the BCS theory.

PHY3822: OPTICS AND LASER PHYSICS

Course Title: **OPTICS AND LASER PHYSICS**
Code: **PHY3822**
NQF Level: 8
Contact Hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course assessment: Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**)
Continuous Assessment will consist of two (2) class tests, at least two (2) assignments and practical report(s) and/or presentation(s) consolidated to one (1) practical mark
Pre-requisites: PHY3601: Optics, PHY3651: Mechanics & Waves and PHY3711: Electrodynamics
Co-requisites: None
Course description: This course will give opportunity to students to have mastery on various phenomenon based on the wave nature of light and that light is a transverse wave. The main contents of this course will be: Interference: Division of amplitude, Division of wavefronts, Thin films, Interferometers, Multiple reflections and Refractions; Diffraction: Fresnel's diffraction, Fraunhoffer diffraction, Kirchhoff's diffraction theory, Single slit, Double slit and gratings, and Monochromatic aberrations; Polarization: Plane polarized light, Circularly polarized light, Elliptically polarized light, Double refraction, Quarter wave plate, Babinet compensator, Polarimeters, Specific rotation; Introduction to lasers: Basics of lasers, He-Ne laser, N_2 laser and CO_2 laser; Applications.

PHY3802: NUCLEAR PHYSICS

Course title: **NUCLEAR PHYSICS**
Code: **PHY3802**
NQF Level: 8
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course assessment: Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**)
Continuous Assessment will consist of two (2) class tests, at least two (2) assignments and practical report(s) and/or presentation(s) consolidated to one (1) practical mark
Pre-requisites: PHY3752: Modern Physics or PHE3751: Modern Physics for Educators
Co-requisites: None
Course description:: Nuclear Structure, nuclear radius, nomenclature; Decay of the nucleus, alpha decay, beta decay, gamma decay, spontaneous fission; Radioactivity, radioactive growth and decay, transient equilibrium, secular equilibrium, radioactive decay series, carbon dating; Chart of Nuclides; Nuclear reactions, elastic scattering, inelastic scattering, reaction of transmutation, radiative capture, photodisintegration, induced fission; Interaction of radiation with matter, photoelectric effect, pair production, Compton scattering, calculation of energy transferred in Compton scattering using relativistic equations; The liquid drop model, variation of binding energy per nucleon with mass number; Weizsacher's semi-empirical mass formula; The shell model; Nuclear energy, nuclear reactors, introductory reactor physics, nuclear power plants; Nuclear instrumentation, radiation detectors, accelerators; Two body systems and nuclear force: properties of nuclear forces, the deuteron, qualitative treatment of n-p and p-p scattering at low energies; Elementary particle.

PHY3842: ASTROPHYSICS

Course title: **ASTROPHYSICS**
Code: **PHY3842**
NQF level: 8
Contact hours: 28 Lectures and 7 Practical Sessions/Tutorials

Credits: 8
Course assessment: Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**)
Continuous Assessment will consist of two (2) class tests, at least two (2) assignments and practical report(s) and/or presentation(s) consolidated to one (1) practical mark
Pre-requisites: PHY3752: Modern Physics
Co-requisites: None

Course description: The Origins of Astronomy; Observational Techniques; Introduction to the c-g-s system of Units;Basic Observations: Review of Blackbody Radiation; Measurement of Stellar Parameters; The Hertzsprung-Russel Diagram; Hydrostatic Equilibrium; The Virial Theorem; Mass Continuity; Radiative Energy Transport; Energy Conservation; The Equations of Stellar Structure; The Equation of State; Opacity; Scaling Relations on the Main Sequence; Nuclear Energy Production; Nuclear Reaction Rates; Solution of the Equations of Stellar Structure; Convection; Stellar Evolution; White Dwarfs; Supernovae & Neutron Stars; Pulsars & Supernova Remnants; Black Holes; Interacting Binaries; Star Formation & the Interstellar Medium: Cloud Collapse & Star Formation; H II Regions; Components of the Interstellar Medium; Dynamics of Star-Forming Regions; Practical Astronomy: Time: Calendars; Julian day number; ST, UT, GST, LST, ET, TDT; Conversions; Spherical geometry; Celestial sphere; Coordinates: Horizon, Equatorial, Ecliptic, Galactic; Generalised coordinate transformations; Conversions.

REP3802: ASPECTS OF RENEWABLE ENERGY PHYSICS

Course Title: **ASPECTS OF RENEWABLE ENERGY PHYSICS**
Code: **REP3802**
NQF Level: 8
National Professional: None
Contact Hours: 28 Lectures and 7 Practical Sessions/Tutorials
Credits: 8
Course assessment: Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**)
Continuous Assessment will consist of two (2) class tests, at least two (2) assignments and practical report(s) and/or presentation(s) consolidated to one (1) practical mark
Pre-requisites: PHY3701: Thermodynamics & Kinetic Theory and PHY3752: Modern Physics
Co-requisites: None

Course description: Physics of energy – fundamentals of: energy sources, energy conversion, energy transmission, energy use, energy efficiency, sustainability; introduction to photovoltaics; Solar thermal energy; Introductory concepts in other renewable energy technologies like wind, tidal, biomass and geothermal energy sources;

PHY3880: RESEARCH METHODOLOGY & PROJECT

Course title: **RESEARCH PROJECT**
Code: **PHY3880**
NQF Level: 8
Contact hours: At least one (1) contact hour per week with supervisor
Credits: 38
Course assessment: Continuous Assessment **(100%)** only
A typed report of the research in the form of a micro thesi/dissertation must be submitted by the student. This will be evaluated by qualified staff within the field. During the course of the project, the student will also be expected to submit a typed project proposal and orally present the progress of his/her work in the department. Aditionally, the student must either orally present his/her work or produce a poster of his/her work at the annual Faculty of Science Research Conference.
Pre-requisites: Programme entry requirements only
Co-requisites: None

Course description: This one-year course constitutes the research and report writing for an available project within the various fields of physics. The actual content of the course will depend on the topic of research selected by the student, from the available specialized fields within the department. The student will submit a written research report of the project upon completion of the research activities. **For graduates from older programmes that did not include Research Methodology, there shall be a short, block-course based "summer school" where the essentials of Research Methodology shall be taught.**

H.1.11. PHYSICS COURSE EQUIVALENTS

OLD COURSE	EQUIVALENT NEW COURSE
PHY3511: Physics for Physical Sciences I	PHY3511: Physics for Physical Sciences I
PHY3512: Physics for Physical Sciences II	PHY3512: Physics for Physical Sciences II
PHY3611: Classical Mechanics	Phased out
PHY3631: Waves & Optics	Phased Out
PHY3612: Electromagnetism	PHY3612: Electromagnetism
PHY3711: Electrodynamics	PHY3711: Electrodynamics
PHY3701: Thermodynamics & Kinetic Theory	PHY3701: Thermodynamics & Kinetic Theory
PHY3721: Computational Physics with C++	PHY3741: Computational Physics
PHY3712: Theoretical Mechanics	Phased out
PHY3732: Modern Physics II	PHY3752: Modern Physics
PHY3702: Electronics I	Phased out
PHY3722: Research Methodology	PHY3722: Research Methodology
PHY3811: Quantum Mechanics	PHY3811: Quantum Mechanics
PHY3831: Statistical Mechanics	PHY3831: Statistical Mechanics
PHY3810: Research Project	PHY3810: Research Project
PHY3809: Advanced Electrodynamics	PHY3809: Advanced electrodynamics
PHY3821: Plasma Physics	PHY3821: Plasma Physics
PHY3812: Solid State Physics	PHY3812: Solid State Physics
PHY3802: Nuclear Physics	PHY3802: Nuclear Physics
PHY3822: Optics and Laser Physics	PHY3822: Optics & Laser Phyics
PHY3842: Astrophysics	PHY3842: Astrophysics
PHY3862: Advanced Potential Field Methods	Phased Out
PHY3402: Physics for Radiographers	PHY3402: Physics for Radiographers
PHY3401: Physics for Life Sciences I	PHY3501: Physics for Life Sciences I
PHY3412: Physics for Life Sciences II	PHY3532: Physics for Life Sciences II

H.1.12. BACHELOR OF SCIENCE IN CHEMISTRY (HONOURS) MEDICINAL: 11BSCC

QUALIFICATION: B.Sc. in CHEMISTRY (HONOURS) 11BSCC

Students opting for a MEDICINAL CHEMISTRY application must take all of the following courses:

YEAR 1

SEMESTER	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Chemistry 1A	CHM3511	16		None
1	Basic Mathematics	MAT3511	16		None
1	English Communication and Study Skills	LCE3419	16		None
1	Computer Literacy	CLC3509	8		None
1	Physics for Physical Sciences I	PHY3511	16		None
1	Introduction to Biology	BLG3511	16		None
2	Chemistry 1B	CHM3512	16		CHM3511
2	Precalculus	MAT3512	16		None
2	English for Academic Purposes	LEA3519	16		None
1&2	Contemporary Social Issues	CSI3580	8		None
2	Introduction to Statistics	STS3522	8		None
2	Diversity of Life	BLG3512	16		None
Total Credits			**168**		

Year 2

SEMESTER	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Inorganic Chemistry I	CHM3611	16	CHM3511, CHM3512	None
1	Physical Chemistry I	CHM3631	16	CHM3511, CHM3512 MAT3511, MAT3512	None
1	Organic Chemistry I	CHM3651	16	CHM3511, CHM3512	None
1	Calculus I	MAT3611	16	MAT3512	None
2	Physics for Physical Sciences II	PHY3512	16		None
2	Analytical Chemistry I	CHM3602	8	CHM3511; CHM3512	None
2	Biomolecules and Catalysis	CHB3632	16	CHM3511; CHM3512;	CHM3651
2	Introduction to Microbiology	MBL3632	16	BLG3511; BLG3512	None
Total Credits			**120**		

YEAR 3

SEMESTER	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Industrial Chemistry I	CHM3761	8	CHM3611; CHM3651	None
1	Inorganic Chemistry II	CHM3751	16	CHM3611 MAT3512	None
1	Analytical Chemistry II	CHM3721	8	CHM3602	None
1	Bioenergetics and Metabolism	CHB3731	16	CHB3632	None
1	Drug Discovery and Development	CHP3721	8	CHM3651	None
1	Medicinal Chemistry I	CHP3741	8	CHM3651	CHP3721
1	Biochemical Analysis	CHB3741	8	CHB3632	None
1	Microbial Genetics	MBG3711	16	MBL3632	none
2	Organic Chemistry II	CHM3752	16	CHM3651	None
2	Instrumental Analysis I	CHM3702	8	CHM3602 CHM3651	None
2	Physical Chemistry II	CHM3712	16	CHM 3631, MAT3611	None
2	Research Methodology	CHM3722	8	Pass all second year Chemistry compulsory courses	None
2	Transmission of Genetic Information	CHB3722	8	CHB3632	None
2	Biosafety, Bioethics and Intellectual property Rights	CHB3742	8	None	CHB3731
Total Credits			**152**		

YEAR 4

SEMESTER	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Instrumental Analysis II	CHM3801	8	CHM3702	None
1	Organic Chemistry III	CHM3811	16	CHM3752	None
1	Physical Chemistry III	CHM3831	16	CHM 3631; MAT3611	None
1&2	Research Project	CHM3810	32	Pass in all third year Chemistry courses and at least one statistics course	None
1	Natural Product Chemistry I	CHM3821	8	CHM3752, CHM3702	None
2	Industrial Chemistry II	CHM3812	16	CHM3712 CHM3761	None
2	Inorganic Chemistry III	CHM3802	8	CHM3751, CHM3752	None
2	Natural Product Chemistry II	CHM3822	8	CHM3752,	CHM3801
2	Medicinal Chemistry II	CHP3842	8	CHP3741, CHP3721	CHM3811
2	Medical Bacteriology	MIC3862	8	MBG3711	None
Total Credits			**128**		

H.1.13. BACHELOR OF SCIENCE IN CHEMISTRY (HONOURS) ENVIRONMENTAL CHEMISTRY APPLICATION: 11BSEC

QUALIFICATION: BSC IN CHEMISTRY (HONOURS) 11BSEC

Students opting for ENVIRONMETAL CHEMISTRY application must take all of the following courses:

YEAR 1

SEMESTER	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Chemistry 1A	CHM3511	16		None
1	Basic Mathematics	MAT3511	16		None
1	English Communication and Study Skills	LCE3419	16		None
1	Physics for Physical Sciences I	PHY3511	16		None
1	Computer Literacy	CLC3509	8		None
1	Introduction to Biology	BLG3511	16		None
2	Chemistry 1B	CHM3512	16		CHM3511
2	Precalculus	MAT3512	16		None
2	English for Academic Purposes	LEA3519	16		None
1&2	Contemporary Social Issues	CSI3580	8		None
2	Introduction to Statistics	STS3522	8		None
2	Diversity of Life	BLG3512	16		None
Total Credits			**168**		

YEAR 2

SEMESTER	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Inorganic Chemistry I	CHM3611	16	CHM3511, CHM3512	None
1	Physical Chemistry I	CHM3631	16	CHM3511, CHM3512 MAT3511, MAT3512	None
1	Organic Chemistry I	CHM3651	16	CHM3511,CHM3512	None
1	Calculus I	MAT3611	16	MAT3512	None
1	Radiochemistry	CHP3621	8	CHM3511;CHM3512	None
2	Physics for Physical Sciences II	PHY3512	16		None
2	Analytical Chemistry I	CHM3602	8	CHM3511;CHM3512	None
2	Introduction to Earth Systems	GLY3502	8		None
2	Introduction to Microbiology	MBL3632	16	BLG3511;BLG3512	None
Total Credits			**120**		

YEAR 3

SEMESTER	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Industrial Chemistry I	CHM3761	8	CHM3611; CHM3651	none
1	Inorganic Chemistry II	CHM3751	16	CHM3611 MAT3512	none
1	Analytical Chemistry II	CHM3721	8	CHM3602	none
1	Water Analysis	CHP3701	8	CHM3602	none
1	Environmental Chemistry I	CHP3711	16	CHP3621	none
1	Microbial Genetics	MBG3711	16	MBL3632	none
2	Organic Chemistry II	CHM3752	16	CHM3651	none
2	Instrumental Analysis I	CHM3702	8	CHM3602 CHM3651	none
2	Physical Chemistry II	CHM3712	16	CHM 3631, MAT3611	none
2	Research Methodology	CHM3722	8	Pass in all second year chemistry compulsory courses	none
2	Crystallography & Mineral Chemistry	GLY3632	16	MAT3512 & CHM3512	none
Total Credits			**136**		

YEAR 4

SEMESTER	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Instrumental Analysis II	CHM3801	8	CHM3702	none
1	Organic Chemistry III	CHM3811	16	CHM3752	none
1	Physical Chemistry III	CHM3831	16	CHM3631; MAT3611	none
1&2	Research Project	CHM3810	32	Pass in all third year chemistry courses and at least one statistics course	none
1	Wastewater Treatment	CHP3811	16	CHP3701, CHP3711	none
2	Industrial Chemistry II	CHM3812	16	CHM3712 CHM3761	none
2	Inorganic Chemistry III	CHM3802	8	CHM3751, CHM3752	none
2	Environmental Chemistry II	CHP3822	8	CHP3711	none
Total Credits			**120**		

H.1.14. BACHELOR OF SCIENCE IN CHEMISTRY (HONOURS) GEOCHEMISTRY CHEMISTRY APPLICATION: 11BSGC

QUALIFICATION: BSC IN CHEMISTRY (HONOURS) 11BSGC

Students opting for a GEOCHEMISTRY application must take all of the following courses:

YEAR 1

SEMESTER 1	COURSE NAME	COURSE CODE	Credits	PRE-REQUISITE	CO-REQUISITE
1	Chemistry 1A	CHM3511	16		none
1	Basic Mathematics	MAT3511	16		none
1	English Communication & Study Skills	LCE3419	16		none
1	Computer Literacy	CLC3509	8		None
1	Physics for Physical Sciences I	PHY3511	16		none
1	Intro. To Phys. Geol. & Surface Proc.	GLY3521	8		none
2	Chemistry 1B	CHM3512	16		CHM3511
2	Precalculus	MAT3512	16		none
2	English for Academic Purposes	LEA3519	16		none
1&2	Contemporary Social Issues	CSI3580	8		None
2	Introduction to Statistics	STS3522	8		none
2	Intro. To Earth Systems	GLY3502	8		None
Total Credits			**152**		

YEAR 2

SEMESTER	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Inorganic Chemistry I	CHM3611	16	CHM3511, CHM 3512	none
1	Physical Chemistry I	CHM3631	16	CHM3511, CHM3512 MAT3511, MAT3512	none
1	Organic Chemistry I	CHM3651	16	CHM3511, CHM3512	none
1	Calculus I	MAT3611	16	MAT3512	none
1	Field Geology I	GLY3600	8	GLY3521	none
2	Physics for Physical Sciences II	PHY3512	16	**PHY3511**	none
2	Analytical Chemistry I	CHM3602	8	CHM3511; CHM3512	none
2	Crystallography & Mineral Chemistry	GLY3632	16	MAT3512/CHM3512	none
2	Introductory to Petrology	GLY3662	8	GLY3521	none
2	Introduction to Geochemistry	GLY3642	8	MAT3512 ; GLY3521 & CHM3512	none
Total Credits			**128**		

YEAR 3

SEMESTER 1	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Industrial Chemistry I	CHM3761	8	CHM3611; CHM3651	none
1	Inorganic Chemistry II	CHM3751	16	CHM3611 MAT3512	none
1	Analytical Chemistry II	CHM3721	8	CHM3602	none
1	Field Geology	GLC3700	8	GLY3521; GLY3662	none
1	Regional Geology of Namibia	GLY3761	8	GLY3521	none
1	Mineralogy	GLY3711	16	GLY3632 ; CHM3512;PHY3601	none
2	Organic Chemistry II	CHM3752	16	CHM3651	none
2	Instrumental Analysis I	CHM3702	8	CHM3602 CHM3651	none
2	Physical Chemistry II	CHM3712	16	CHM 3631, MAT3611	none
2	Research Methodology	CHM3722	8	Pass in all second year Chemistry and Biochemistry courses	none
2	Exploration Geochemistry and Geostatistics	GLY3782	8	GLY3642	none
2	Chemical Metallurgy	GLC3712	16	GLY3662 & GLY3611	none
Total Credits			**136**		

YEAR 4

SEMESTER 1	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Instrumental Analysis II	CHM3801	8	CHM3702	none
1	Organic Chemistry III	CHM3811	16	CHM3752	none
1	Physical Chemistry III	CHM3831	16	CHM 3631; MAT3611	none
1&2	Research Project	CHM3810	32	Pass in all third year chemistry courses and at least one statistics course	none
1	Geochemical Analysis	GLC3821	8	GLY3662;GLC3700	None
1	Industrial Minerals and Gemstones	GLY3801	8	GLY3711	None
2	Industrial Chemistry II	CHM3812	16	CHM3712 CHM3761	None
2	Inorganic Chemistry III	CHM3802	8	CHM3751, CHM3752	None
2	Petroleum Chemistry	**CHC3822**	8	CHM3752, CHM3761 & CHM3712	None
Total Credits			**120**		

H.1.15. CHEMISTRY COURSE DESCRIPTIONS

FIRST YEAR COURSES

CHM3511 CHEMISTRY 1A

Course Title:	**Chemistry 1A**
Course Code:	**CHM3511**
NQF Level:	5
NQF Credits:	16
Contact Hours:	4 lecture periods per week for one semester; 1 practical session per week for one semester
Course Assessment:	**Continuous Assesment (**minimum of **3** tests which counts 75%, laboratory component 15% and tutorial 10%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite:	None

Course Descriptor: The following topics are covered:Introduction: Matter, Measurement and Molecules; Stoichiometry: Calculations with ChemicalFormulae and Equations; Aqueous Reactions and Solutions Stoichiometry; Electronic Structure of Atoms; Periodic Properties of the Elements and Relationships Among Elements; Basic Concepts of Chemical Bonding; Basic Molecular Geometry and Bonding Theories.

CHM3512 CHEMISTRY 1B

Course Title:	**Chemistry 1B**
Course Code:	**CHM3512**
NQF Level:	5
NQF Credits:	16
Contact Hours:	4 lecture periods per week for one semester; 1 practical session per week for one semester
Course Assessment:	**Continuous Assesment (**minimum of three tests which counts 75%, laboratory component 15% and tutorial 10%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination.
Prerequisite :	None, **Co-requisite:** CHM3511 (Chemistry 1A)

Course Descriptor: The following topics are covered:Gases; Intermolecular Forces, Liquids and Solids; Properties of Solutions; Thermochemistry and Further Aspects of Chemical Thermodynamics; Chemical Kinetics; Chemical Equilibrium; Acid-Base Equilibria Additional Aspects of Aqueous Equilibria: The Common-Ion Effect, Buffer Solutions, Acid-Base Titrations; Electrochemistry.

SECOND YEAR COURSES

CHM3611 INORGANIC CHEMISTRY

Course Title:	**Inorganic Chemistry I**
Course Code	**CHM 3611**
NQF Level	6
Contact Hours:	4 lecture periods per week for one semester and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	**Continuous Assesment (**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3511 (Chemistry 1A), CHM 3512 (Chemistry 1B)

Course Descriptor: This is an introductory course to inorganic chemistry. It builds upon what is covered in the First Year chemistry courses. Students are expected to review the structure of the atom on their own, then the course progresses into its reactivity to form simple and complex molecule. The following topics are covered:In-depth studies of chemical bonding; (valence bond theory (VBT), shapes of molecules and hybridization; molecular orbital theory (MOT) in diatomic and polyatomic molecules); Delocalized multiple bonding. S-block elements: The chemistry of alkali and alkaline earth elements (groups 1 and 2); reactivity with hydrogen, oxygen, halogens, water, and liquid ammonia; Classification of oxides, and their reaction with water; P-block elements (groups 13 to 18): Reactivity with oxygen and halogens; The hydrides of P block elements; Hydrolysis and ammonolysis of P-block halides;

CHM3651 **ORGANIC CHEMISTRY I**

Course Title:	**ORGANIC CHEMISTRY I**
Course Code	**CHM3651**
NQF Level	6
NQF Credits	16
Contact Hours	4 lecture periods per week for one semester; 1 practical session per week for one semester
Course Assessment	**Continuous Assesment (**minimum of three tests which counts 68%, laboratory component 20% and tutorial 12%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination.
Prerequisite	CHM3511 (Chemistry 1A), CHM3512 (Chemistry 1B)

Course Descriptor: Basic concepts: bonding, structural representation, molecular shapes, introduction to stereochemistry, functional groups and their interchangeability, acid-base reactions of carboxylic acids and amines; Alkanes and cycloalkanes: nomenclature, physical properties, conformational analysis, bicyclic and polycyclic alkanes, reactions and synthesis of alkanes. Stereochemistry: stereoisomers, enantiomers, chirality, diastereomers, racemates, meso compounds, optical activity, resolution. Nucleophilic substitution and elimination: nucleophiles and electrophiles, S_N2 and S_N1 reactions; carbocations and carbanions, E1 and E2 reactions. Alkenes and alkynes: physical properties and synthesis, hydrogenation, index of hydrogen deficiency, preparation, addition reactions, Markovnikov's rule, hydroboration, oxidation reactions. Radical reactions: free radicals, halogenation of alkanes, chain reactions. Alcohols and ethers: synthesis, reactions, mesylates and tosylates, epoxides, crown ethers, phase transfer catalysis, synthesis and reactions of epoxides.

CHM3631 PHYSICAL CHEMISTRY I

Course Title:	**Physical Chemistry I**
Course Code	**CHM3631**
NQF Level	6
Contact Hours:	4 lecture periods per week for one semester and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	**Continuous Assesment (**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3511(Chemistry 1A), CHM3512 (Chemistry 1B), MAT3511 (Basic Mathematics), MAT3512 (Precalculus)

Course Descriptor: The properties of gases: the perfect gas; real gases. The First Law of Thermodynamics: work, heat, and energy; the change in internal energy; expansion work; heat transactions; enthalpy; adiabatic changes; thermochemistry; state functions and exact differentials. The Second Law of Thermodynamics: the direction of spontaneous change and the dispersal of energy; entropy; Carnot cycle; entropy changes accompanying specific processes. The Third Law of thermodynamics. The Helmholtz and Gibbs energies.Standard reaction Gibbs energies. Combining the First and Second Laws of Thermodynamics. Physical transformations of pure substances: phase diagrams; phase stability and phase transitions. Simple mixtures: the thermodynamic description of mixtures; the properties of solutions. Chemical equilibrium: spontaneous chemical reactions; the response of equilibria to different conditions.

CHP3621 RADIOCHEMISTRY

Course Title:	**Radiochemistry**
Course Code	**CHP3621**
NQF Level	6
Contact Hours:	2 lecture periods per week for one semester
NQF Credits	8
Contact Hours	2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Course Assessment	**Continuous Assesment (**minimum of two tests which counts 75% and Assignment plus laboratory component 25%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3511; CHM3512

Course Descriptor: Radiochemistry: Stability of the nucleus, modes of radioactive decay, kinetics of decay, secular and transient equilibrium, methods of measurement, statistics, health and safety, applications of ionising radiation in chemistry and biochemistry.

CHB3632 BIOMOLECULES AND CATALYSIS

Course Title:	**Biomolecules and Catalysis**
Course Code	**CHB3632**
NQF Level	6
Contact Hours:	4 lecture periods per week for one semester and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	**Continuous Assesment (**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3511 (Chemistry 1A, and CHM3512 (Chemistry 1B)
Corequisite	CHM3651OrganicChemistry I

Course Descriptor: The following topics are covered:**Composition and structure of biomolecules; Biochemical reactions in aqueous solutions; Energy and biochemical reactions; The medium of Life – Water; Isomers/Stereoisomers and chirality in biochemical systems; Thermodynamics of Biological Systems; Carbohydrates:** Structure and Chemistry; Glycoproteins and their functions; Reactions; **Lipids:** classification and structure; terpenes and steroids; fatty acids; triacylglycerols; glycerophospholipids and glycosphingolipids; **Amino acids and proteins:** structure and properties; reactions; separation and analysis of mixtures of amino acids; ionisation; folding and conformation; **Membranes and membrane transp**ort**:** chemical and physical properties of membranes; structure and chemistry of membrane proteins; Transport across biological membranes; importance of light energy in transport processes; **Nucleotides and Nucleic acids:** structure and chemistry of nitrogenous bases; nucleosides; structure and chemistry of nucleotides; different classes of nucleic acids; structures of nucleic acids; **Introduction to Enzymes:** nomenclature; proteins as catalysts; kinetics and specificity; kinetics of enzyme-catalysed reactions; inhibition of enzyme activity; **Introduction to Mechanisms of enzyme action and enzyme regulation**

CHM3602 ANALYTICAL CHEMISTRY I

Course Title:	**Analytical Chemistry I**
Course Code	**CHM3602**
NQF Level	6
NQF Credits	8
Contact Hours	2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Course Assessment	**Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3511 (Chemistry 1A), CHM3512 (Chemistry 1B)

Course Descriptor: Review of some fundamental concepts; sampling and sample preparation; expressions of concentration and content; evaluation of analytical data; measures of accuracy and precision; random and systematic errors; aqueous equilibria; mass and charge balance equations; principles of titrimetry; acid-base titrations; titration curves and indicators; applications of acid-base titrations; distillation, extraction, gravimetric methods of analysis; common ion and diverse ion effects; precipitation titrations; indicators used in precipitation titrations; introduction to chromatographic methods; gas chromatography; principles of gas-liquid chromatography; and basic information about spectroscopic methods of analysis.

THIRD YEAR COURSES

CHB3741 BIOCHEMICAL ANALYSIS

Course Title: **Biochemical Analysis**
Course Code **CHB3741**
NQF Level 8
NQF Credits 8
Contact Hours: 2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
Course Assessment **Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite Biomolecules and Catalysis (CHB3632)

Course Descriptor**:** Review of Amino Acids, Peptides and Proteins**; Separation Methods:** Principles of Separation techniques, Methods based on: polarity, ionic nature, size and shape; Chromatography and Spectroscopy; **Immunological Methods:** Antigen-Antibody reactions, precipitation reaction, immunoassay: **Enzymes:** enzyme assay methods; **Carbohydrates:** chemical and enzymatic methods; identification of carbohydrate mixtures; **Amino Acids:** n-terminal analysis, reactions and separation of amino acids, amino acid analyser; **Proteins:** methods of separation and quantitation; **Lipids:** Sample preparation and handling, separation and quantitation; **Nucleic Acids**: Isolation and purification, analysis, vectors and sequencing, matrix-assisted laser desorption-ionization mass spectroscopy MALDI-MS, (MALDI-TOF)

CHP3701 WATER ANALYSIS

Course Title: **Water Analysis**
Course Code **CHP3701**
NQF Level 7
NQF Credits 8
Contact Hours 2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Course Assessment **Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite Analytical Chemistry I (CHM3602)
Compulsory/Elective Elective

Course Descriptor: Surface water, Ground water, drinking water quality, physical properties of ground water and its occurrence, water analysis: physical properties of water, determination of chlorides, sulphates, carbonates, bicarbonates, acidity, turbidity, pH, metal ions, Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), suspended solids (SS), Total Dissolved Solids (TDS), residual chlorine, Water management.

CHB3731 BIOENERGICS AND METABOLISM

Course Title: **Bioenergics and Metabolism**
Course Code **SCHB3731**
NQF Level 7
Notional Hours 160
Contact Hours: 4 lecture periods per week for one semester and 1 practical session per week for one semester
NQF Credits 16
Course Assessment **Continuous Assesment (**minimum of three tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite CHB3632 **(**Biomolecules and Catalysis)

Course Descriptor: The following topics are covered:**Introduction to metabolism:** metabolic pathways and organic reaction mechanisms; experimental approaches in metabolism; thermodynamics of phosphate groups and thermodynamics of life**; Glucose metabolism:** Glycolysis; pathways; reactions; fermentation; other hexoses metabolism; **Other pathways of carbohydratemetabolism:Glycogen** breakdown; - synthesis; - control; -storage diseases; gluconeogenesis; Glyoxylate cycle; Biosynthesis of Oligosaccharides and glycoproteins; pentose phosphate pathway; **Citric Acid Cycle:** Cycle overview; Conversion of pyruvate to acetyl-CoA; Enzymes of the citric acid cycle; catabolic and anabolic of the citric acid cycle; Regulation of the citric acid cycle; **Lipid metabolism:** lipid digestion, absorption and transport; fatty acid oxidation and ketone bodies; fatty acid synthesis; synthesis of other lipids; cholesterol metabolism; phospholipid and glycolipid metabolism; **Amino acid metabolism:** amino acid deamination; amino acid biosynthesis; Nitrogen fixation and assimilation; transamination; Metabolic breakdown of individual amino acids; amino acids as metabolic precursors; nitrogen fixation

CHP3741 MEDICINAL CHEMISTRY I

Course Title: **Medicinal Chemistry I**
Course Code **CHP3741**
NQF Level 8
NQF Credits 8
Contact Hours 2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Course Assessment **Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite CHM3651(Organic chemistry I, prerequisite), SCHP3721 (Drug Discovery & Development, co-requisite)

Course Descriptor: Design, discovery, and preparation of biologically active compounds; mechanisms of drug action; pharmacokinetics: absorption, distribution, drug metabolism, excretion; prodrugs and drug delivery systems; lead optimization:retrosynthetic analysis, functional groups and isosteres, functionalisation of aromatic rings, construction of rings, heterocyclic chemistry; stereoselective synthesis and stereochemistry in drug design. Structure-activity relationships and quantitative structure-activity relationships. Molecular targets for drugs: receptors, enzymes, ion channels, DNA and unexplored targets revealed by the human genome project.

CHP3721 DRUG DISCOVERY & DEVELOPMENT

Course Title: **Drug Discovery & Development**
Course Code **CHP3721**
NQF Level 8
NQF Credits 8
Contact Hours 2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Course Assessment **Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite CHM3651 (Organic chemistry I)
Course Descriptor: History of drug discovery; stages in the drug development process; classification of drugs; sources of drugs and lead compounds; bioassays; pharmacophores; target-based and structure-based drug design; clinical trials; ethics, patents; strategies in drug discovery for communicable and non-communicable diseases; impact of genomics, combinatorial chemistry and other modern techniques on drug research; case studies to outline the drug development process;

CHM3721 ANALYTICAL CHEMISTRY II

Course Title: **Analytical Chemistry II**
Course Code **CHM3721**
NQF Level 7
NQF Credits 8
Contact Hours 2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Course Assessment **Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite CHM3602 (Analytical Chemistry I)
Course Descriptor: Complexometric methods and EDTA titrations; oxidation reduction, oxidation states and balancing redox equations, the half-cell concept; voltaic cells and the Nernst equation; redox titrations and redox titration curves; applications of redox titrations, coulometric and potentiometric methods of analysis.

CHM3751 INORGANIC CHEMISTRY II

Course Title: **Inorganic Chemistry II**
Course Code **CHM3751**
NQF Level 7
Contact Hours: 4 lecture periods per week for one semester and1 practical session per week for one semester
NQF Credits 16
Course Assessment **Continuous Assesment (**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite CHM3611 (Inorganic Chemistry I), MAT3512 (Precalculus)
Course Descriptor: The following topics are covered:
Transition metal chemistry: transition metal complexes (constitution, nomenclature, isomerism, classification of ligands); Bonding-Application of Valence Bond Theory (VBT); Crystal Field Theory (CFT); Ligand Field Theory (LFT). Molecular Orbital Theory (MOT); Reaction Mechanisms and rate of reactions; Ligand substitution; Dissociative and Associative mechanisms; redox and photochemical reactions in transitional complexes. Chemical applications of group theory: Continuation of symmetry elements and symmetry operations, point group and character tables. Symmetry applications; Infrared and Raman spectroscopy. In-depth treatment of chemical bonding and molecular orbital theory, Electronic spectra of transition metal complexes; Russel-Saunders and ligand field terms, selection rules and electronic transitions

CHP3711 ENVIRONMENTAL CHEMISTRY I

Course Title: **Environmental Chemistry I**
Course Code **CHP3711**
NQF Level 7
NQF Credits 16
Contact Hours 4 lecture periods per week for one semester; 1 practical session per week for one semester
Course Assessment **Continuous Assesment (**minimum of 3 tests which counts 75% and laboratory component 25%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite Radiochemistry (CHP3621)
Course Descriptor: Environmental radioactivity, radiochemical methods of analyses of environmental samples, radiological protection, dosimetry and the associated legislation Perceptions of the Environment, Natural Environments, Environmental Variation, The atmosphere and atmospheric chemistry, soil chemistry, Environmental Assessment Process, An Introduction to Climate Change, Climate Change Adaptation.

CHB3722 TRANSMISSION OF GENETIC INFORMATION

Course Title: **Transmission of Genetic Information**
Course Code **CHB3722**
NQF Level 7
Contact Hours: 2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
NQF Credits 8
Course Assessment **Continuous Assesment (**minimum of 2 tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite Biomolecules and Catalysis (CHB3632)
Course Descriptor: This course is designed to teach the students the Expression and transmission of genetic information: The following topics are covered: **Nucleotide metabolism:** synthesis of purine ribonucleotidees; synthesis of pyrimidine ribonucleotides; formation of deoxyribonucleotides; nucleotide degradation; biosynthesis of nucleotide Coenzyme; **DNA Metabolism:** DNA Replication,

Recombination and Repair; **RNA Metabolism:** Transcription and RNA Processing; **Protein Metabolism:** Translation and Posttranslational Modification; Genes and Chromosomes, Regulation of Gene Expression; Recombinant DNA technology

CHM3761 INDUSTRIAL CHEMISTRY I

Course Title:	**Industrial Chemistry I**
Course Code	**CHM3761**
NQF Level	7
Contact Hours:	2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
NQF Credits	8
Course Assessment	**Continuous Assesment (**minimum of 2 tests which counts 80% and laboratory component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3611 (Inorganic Chemistry I), CHM3651 (Organic Chemistry I)

Course Descriptor: The following topics are covered: **Sources of chemical industry:** inorganic chemicals, organic chemicals from biomass, coke, natural gas, crude oil. **The w**or**ld's maj**or **chemical industries:** introduce the major companies and products. **Environmental pollution control:** the techniques of pollution control including physic, chemical and biological methods. **Material and energy balance:** the methods of mass and energy balance, the calculation process of industrial chemistry. **Technological economics:** cost and profit of producing processes, effects of scale and flow rate of operation. **Oil and fat industry:** structure, isolation, additives, applications. **Coatings industry:** composition, pigments, binders, solvents. **Soap and domestic industry:** soap, surfactant, detergent. **Leather industry**: softening, evaluating effects of fat in leather. **Flav**or **industry:** vehicles, fixatives, synthetics used in perfume and flavors; perfume formation. **Pharmaceutical industry:** type of drugs, antibacterial agents, steroids, analgesics, antihistamines. **Meat industry:** kinds of meat, prepared and preserved products. **Fish industry:** categories of fish, prepared and preserved products. **dairy industry:** prepared and preserved products. **Biotechnology industry:** beer, cheese. **Sulfuric acid and fertilizer industry:** manufacture of sulfuric acid and fertilizer. **Salt industry:** manufacture of caustic. **Uranium industry:** extraction, concentration and purification of uranium. **Cement industry:** the compositions and manufacture of cement, processes in the solidification cement.

CHM3752 ORGANIC CHEMISTRY II

Course Title:	**ORGANIC CHEMISTRY II**
Course Code	**CHM3752**
NQF Level	7
NQF Credits	16
Contact Hours	4 lecture periods per week for one semester; 1 practical session per week for one semester
Course Assessment	**Continuous Assesment (**minimum of 3 tests which counts 68%, laboratory component 20% and quiz 12%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3651 (Organic Chemistry I)

Course Descriptor: Carbonyl compounds: structure and reactions with nucleophiles, Oxidation-reduction in organic chemistry, alcohols by reduction, oxidation of alcohols, organometalic compounds. Basic spectroscopy: IR, NMR, MS. Conjugated systems: allyl radical and allyl cation, alkadienes and polyunsaturated hydrocarbons, 1,2- and 1,4-addition, Diels-Alder reaction. Aromatic compounds: Hückel's rule, aromatic-, antiaromatic-, nonaromatic-classification; annulenes, fullerenes, Heterocyclic compounds. Electrophilic aromatic substitution: halogenation of benzene, nitration, sulfonation, Friedel-Crafts-alkylations and acylations. Protecting and blocking groups. Aldehydes and ketones: synthesis; addition to carbon-oxygen double bond, hydride, hydrogen cyanide, alcohols, derivatives of ammonia, oxidation; Wittig reaction. tautomers, enolates, aldol reactions, aldol reactions.

CHM3712 PHYSICAL CHEMISTRY II

Course Title:	**Physical Chemistry II**
Course Code	**CHM3712**
NQF Level	7
Contact Hours:	4 lecture periods per week for one semester, 1 tutorial session per week for one semester and 1 practical session per week for one semester
NQF Credits	16
Course Assessment	**Continuous Assesment (**minimum of 3 tests which counts 70%, laboratory component 20% and Quiz 10%). **Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3631 (Physical Chemistry I), MAT3611 (Calculus I)

Course Descriptor: The rates of chemical reactions: rate expressions; order and molecularity. Integrated rate equations.Methods of determining order or reaction and rate coefficient.Temperature dependence of rate coefficients (Arrhenius equation).Complex reactions – parallel, opposing, consecutive and chain reactions.Reaction mechanism.Enzyme kinetics. Theories of reaction rates: collision theory; transition state theory. Experimental methods for studying slow and fast reactions.Definition and measurement of conductivity and molar conductivity. Kohlrausch's law. Strong and weak electrolytes.Ostwald dilution law. Ionic mobilities and transport numbers. Applications of conductivity measurements – dissociation constant, solubilities and solubility products of sparingly soluble salts, conductometric titrations.Thermodynamics of electrolyte solutions. Thermodynamics of electrochemical cells, Surface chemistry and colloids: Chemical, biological and medicinal applications of colloids. Processes at electrodes: The electrode-solution interface. The rate of charge transfer.Butler-Volmer equation.Surface tension and interfacial tension, Spreading of one liquid on another. Insoluble monolayer films and their application in water evaporation control. Detergency.Formation and stability of emulsions. Chemisorption and Physisorption. Adsorption isotherms: Langmuir, Freundlich and BET adsorption equations.

CHB3762 INNOVATION AND ENTREPRENEURSHIP

Course Title:	**Innovation and Entrepreneurship**
Course Code	**CHB3762**
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for one semester
Course Assessment	**Continuous Assesment (**minimum of 2 tests which counts 80% and Internship and or Innovation project applied component 20%). **Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	Drug desing and development CHP3721, Biochemical Analysis, CHB3741

Course Descriptor: Introduction to innovation and entrepreneurship; Entrepreneurship in biotechnology (Context specific); Or**ganizational Structures;** Virtual and Real Enterprises; R & D Networks; Outsourcing Registrations/Permissions: **Markets and Fact**ors: Products and Services, Economies, Manpower, Resources **Research and Development;** product life cycle, R&D cycle and organizational life cycle; Biology, Medicine, and Genetics, Pre-clinical and Clinical Development, Processes, Pilot Plants, Engineering, Fermentation Process Development; **Safety:** Medical Safety, Biological Safety, Chemical Safety, Equipment Safety, **Intellectual assets** –capital in biotechnology firms; managing IP in biotechnology firms; **biotechnology value chain**; Biotechnology industry and firm structures; Product development and innovation diffusion.

CHB3742 BIOSAFETY, BIOETHICS AND IPR

Course Title:	**Biosafety, Bioethics and IPR**
Course Code	**CHB3742**
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of 2 tests which counts 80% and laboratory component 20%).**Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	None, **Co-requisite:** Bioenergics and Metabolism (CHB3731)

Course Descriptor: Principles of biosafety, bioethics and bio-law: Environmental and food safety Risk assessment, ethics; philosophy; Regulation of human tissue and stem cells; International environmental law; Intellectual property law and the biosciences, Patenting Life; Surveying of Methods and Uses of Animal Biotechnology. Legal and socio-economic considerations regarding biotechnology; human safety; animal welfare; Public policy, regulatory and ethical challenges facing the entrepreneurial biotechnology firm.

CHM3702 INSTRUMENTAL ANALYSIS I

Course Title:	**Instrumental Analysis I**
Course Code	**CHM3702**
NQF Level	7
NQF Credits	8
Contact Hours	2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3602 (Analytical Chemistry I), CHM 3651 (Organic Chemistry I)

Course Descriptor: ultraviolet spectroscopy; infrared absorption spectroscopy; theory and applications of IR; flame emission and atomic absorption spectrometry; molecular fluorescence and phosphorescence; NMR spectroscopy; theory and experimental methods of NMR spectroscopy; applications of proton NMR spectroscopy and mass spectrometry.

CHM3722 RESEARCH METHODOLOGY

Course Title:	**Research Methodology**
Course Code	**CHM3722**
NQF Level	7
Contact Hours:	2 lecture periods per week for one semester
NQF Credits	8
Continuous Assesment	(minimum of two tests which counts 65%, Assignments, Oral & Poster presentation 15%, a minimum of two equally weighted statistics exercises (10%),oral presentation using PowerPoint (5%) and a Poster presentation (5%)). **Final: 100%** CA
Prerequisite	Pass in all second year Chemistry and Biochemistry courses

Course Descriptor**:** Ethics of Research and Plagiarism; The scientific method: Logic and scientific, natural observations, asking questions and formulation of hypotheses, Predictions, Types of hypotheses (null, alternative, research); Chemostatics Topics: Handling experimental data; Processing and reporting; Significant tests; Regression analysis; Validation of experimental data (quality control); Optimization of parameters; Use of existing literature; Using the internet and the university library; Finding and using literature references; Citation of references; Writing a literature review; Report Writing; Oral presentation using state-of-the-art equipment; Presenting results as posters

FOURTH YEAR COURSES

CHM3821 NATURAL PRODUCT CHEMISTRY I

Course Title:	**Natural Product Chemistry I**
Course Code	**CHM3821**
NQF Level	8
NQF Credits	8
Contact Hours	2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3752 (Organic Chemistry II), CHM3702 (Instrumental Analysis I)

Course Description: This course explores the basic biosynthesis pathway of secondary metabolites. We will learn how natural products are normally classified according to their biosynthetic origins and chemical properties. A special emphasis will be placed on chemical structure and how it affects the physiological function of various natural products. The following will be covered. **Topics include:** Classification of natural products. Primary and secondary metabolites; NMR techniques in biosynthesis studies (^{13}C-NMR, isotope incorporation). Polyketide pathway: fatty acids, cyclization of polyketides to aromatics, skeletal types of polyketides. The shikimic acid pathway: biosynthesis of shikimic acid and aromatic amino acids, biosynthesis of phenylpropanoids and other metabolites from the shikimate pathway. Isoprenoids: biosynthesis of mevalonic acids, monoterpenes, sesquiterpenes, diterpernes, sesterterpenes, triterpenes, tetraterpenes and steroids.

CHB3831 BIOINFORMATICS FOR BIOCHEMISTRY

Course Title:	**Bioinformatics for Biochemistry**
Course Code	**CHB3831**
NQF Level	8
NQF Credits	16
Contact Hours	4 lecture periods per week and 1 practical session per week for one semester
Continuous Assesment	**(**minimum of three tests which counts 80% and laboratory component 20%).**Examination:** 1x3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	**CHB3731** (Bioenergics and metabolism), **MBL3631** (Cell Molecular Biology and Genetics)

Course Descriptor**:** The development of rapid DNA sequencing techniques has led to an information revolution in molecular biology. Computer based technologies are therefore applied and employed in the management and analysis of such biological data. This course is a hand-on and inactive course in which students will acquire knowledge on information networks, the World Wide Web as a tool and resource for molecular biology. They will gain skills and knowledge in using these resources in sequence and structure analysis. The various genomic and proteomic databases and the levels of stored data will be discussed and applied in depth. This will lead to the identification of characteristic profiles, protein families, evolutionary relationships, etc. the module will also include the design of PCR and oligonucleotide primers for cloning and mutagenesis as well as identifying open-reading frames (ORFs) in nucleotide sequences. The course will consist of lectures, student presentations and assignments.

CHM3801 INSTRUMENTAL ANALYSIS II

Course Title:	**Instrumental Analysis II**
Course Code	**CHM3801**
NQF Level	8
NQF Credits	8
Contact Hours	2 lectureperiods per week for one semester; 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3702 (Instrumental Analysis I)

Course Descriptor**:** Separation methods; solvent extraction; introduction to chromatographic methods of separation; general description of chromatography. GC, GLC, LC, TLC, HPLC; qualitative and quantitative analysis by chromatography; high performance liquid chromatography, column efficiency and chromatographic mobile phases; partition chromatography; adsorption chromatography ion-exchange chromatography; size exclusion chromatography; planar chromatography; ^{13}CNMR spectra and ^{1}HNMR: 1-dimensional NMR (DEPT, NOE), 2 dimensional NMR (COSY, HETCOR, NOESY) theory, experimental methods and interpretation of spectra.

CHM3811 ORGANIC CHEMISTRY III

Course Title:	**ORGANIC CHEMISTRY III**
Course Code	**CHM3811**
NQF Level	8
NQF Credits	16
Contact Hours	4 lecture periods per week for one semester; 1 practical session per week for one semester
Continuous Assesment	**(**minimum of three tests which counts 68%, laboratory component 20% and Quiz 12%). **Examination:** 1x3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	**CHM3752** (Organic Chemistry II)

Course Descriptor: Enolates: tautomerism, racemisation, halogenations, haloform reaction, Aldol reactions, Claisen-Schmidt reactions, addition to α,β-unsaturated systems. Carboxylic acids and their derivatives: preparations and reactions of acids, acyl chlorides, acid anhydrides, esters, lactones, amides and imides, lactams. β-dicarbonyl compounds: Claisen condensations, crossed Claisen condensations, "active hydrogen" syntheses, direct alkylations of esters and nitriles, simple and conjugate additions to α,β-unsaturated systems, Mannich reactions; Amines: preparations, reactions, Hofmann and Cope elimination reactions. Phenols: physical properties, preparations, O-reactions, C-reactions, rearrangements, nucleophilic aromatic substitutions. Selected examples of multistep synthesis of organic compounds.

CHM3810 RESEARCH PROJECT

Course Title:	**Research Project**
Course Code	**CHM3810**
NQF Level	8
Contact Hours:	2 consultation periods per week for one semester
NQF Credits	32
Continuous Assesment	1 Oral presentation counts 30%, Consultation and efforts counts 20%, 1 Project report counts 50% **Final: 100%** CA
Prerequisite	Passin all third year courses and at least one statistics course

Course Descriptor: An independent project carried out in small groups, under the supervision of a member of staff. Topics will be given to students before the end of the first semester. The work will extend over the term and as a guide, should occupy the equivalent of one whole day per week. The practical work must be completed by six weeks before the session ends and must be submitted by two weeks before the session end. The completed report is expected to be between 25-35 pages long and will be examined by the supervisor and one external examiner and will be defended by an oral exam.

CHC3821 CLINICAL BIOCHEMISTRY

Course Title:	**Clinical Biochemistry**
Course Code	**CHC3821**
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	Bioenergetics and Metabolism (CHB 3731), Medicinal Chemistry I, (CHP3741), Drug discovery and development (CHP3721)

Course Descriptor: Biochemistry of Hormones: Blood and Transport Proteins, Hemostasis and Thrombosis. Bioenergetics and Oxidative Metabolism. Anaerobic Metabolism of Glucose in the Red Cell. Carbohydrate Storage: Synthesis in Liver and Muscles; obesity. Biosynthesis of Cholesterol in Liver .Special Liver Function. Muscle: Energy Metabolism and Contraction. Glucose Homeostasis and Fuel Metabolism. Water and Electrolyte Balance: Kidney Function. Diseases of the Lung and Kidneys: The Control of Acid-Base Balance. Calcium and Bone: osteoporosis; Metabolism. Neurochemistry. Neurotransmitters: psychosis and other nervous disorders Pathology: scientific investigation of the biology of human disease, 'Genes and the cell in health and disease' and 'Infection, Inflammation and immunity, Histochemistry, Immunocytochemistry. Oncology: Biochemical and molecular basis of cancer: Cell Cycle, Programmed Cell death, multistage nature of cancer, including the roles of the environment and somatic mutation, explore the known genetic mechanisms leading to cancer, Discuss approaches to targeted therapies for different cancers, current advances in HIV testing, diagnosis and treatment

CHM3831 PHYSICAL CHEMISTRY III

Course Title:	**Physical Chemistry III**
Course Code	**CHM3831**
NQF Level	8
Contact Hours:	4 lecture periods per week for one semester, 1 tutorial session per week for one semester and 1 practical session per week for one semester
NQF Credits	16
Continuous Assesment	**(**minimum of three tests which counts 60%, laboratory component 20%, Quiz 10% and Assignments 10%). **Examination:** 1x3hr examination; **Final:** 50% CA mark and 50% Examination mark.
Prerequisite	CHM 3631 (Physical Chemistry I), MAT3611 (Calculus I)

Course Descriptor: Failures of classical mechanics and the birth of quantum mechanics. Wave and particle nature of light and electron.Postulates of quantum mechanics.Schrödinger equation and application to simple model systems.Hydrogen atom and multi-electron atoms.Vibrational spectroscopy of diatomic and simple polyatomic molecules.Microwave spectroscopy.Electronic spectroscopy. Calculation of thermodynamic properties from partition functions.

CHP3811 WASTE WATER TREATMENT

Course Title:	**Wastewater Treatment**
Course Code	**CHP3811**
NQF Level	8
NQF Credits	16
Contact Hours	4 lecture periods per week for one semester; 1 practical session per week for one semester
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHP3701 (Water Analysis), CHP3711 (Environmental Chemistry I)

Course Descriptor: The principles of coagulation, flocculation, sedimentation, filtration, biological treatment, solids handling, disinfection, and advanced treatment processes are presented. Physical and Chemical Processes for Water and Wastewater treatment. Biological Processes for Water and Wastewater treatment, characteristics, domestic versus industrial wastewater. Types of industries and their wastewater ,Sampling of wastewater Analysis of industrial wastewater. Examples of wastewater from different industries, BOD, COD, Toxicity, Heavy metals, Dissolved, suspended solids. Uses of water in industry.Cooling, conveying, process, boilers, water heaters, etc. Pretreatment of water for industrial use, Water pretreatment processes as sources of wastewater (Reverse Osmosis, softening, desalination, etc). Pretreatment of waste waters: equalization, settling, coagulation, filtration, pH adjustment, neutralization, flocculation, grit removal, treatment for sewer discharges, treatment for reuse. Agricultural reuse options, Community reuse options, Industrial reuse options. Chemical wastewater treatment: Coagulation, flocculation, precipitation, heavy metals removal, Oxidation, chlorination, other processes. Physical waste water treatment: Reverse Osmosis, Activated charcoal, distillation / evaporation, Biological wastewater treatment, Elementary Microbiology. **Nano technology in waste water treatment: Nano filtration, shapes of nano particles.**

CHP3822 ENVIRONMENTAL CHEMISTRY II

Course Title: **Environmental Chemistry II**
Course Code **CHP3822**
NQF Level 8
Contact Hours 2 lecture periods per week for one semester
NQF Credits 8
Continuous Assesment **(**minimum of two tests which counts 70%, Student led discussions contributes 15%, Paper Review Proposalcontributes 5%, Paper Reviewcontributes 5% and Paper peer Review contribute 5%. **Final: 50%** CA mark and **50%** Examination mark
Prerequisite Environmental Chemistry I (CHP3711)

Course Descriptor: Climate in the Spotlight: Spectrum of Scientific Opinion, Greenhouse Gases: An overview of the role of Carbon dioxide and Methane, Carbon dioxide reservoirs, Climate cycles: Determining the past climates, Climate change and Political realm, Relationships between Technological Innovation and Climate Change, Physical and Social Impacts of Climate Change, Climate Change Adaptation strategies, Implications of the introduction of new technologies for Adaptation and Sustainability, Current international efforts to address climate change.

CHP3842 MEDICINAL CHEMISTRY II

Course Title: **Medicinal Chemistry II**
Course Code **CHP3842**
NQF Level 8
NQF Credits 8
Contact Hours 2 lecture periods per week for one semester; 1 practical session per week for 7 weeks
Continuous Assesment **(**minimum of three tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.

Prerequisite: CHM3811 (Organic chemistry III, **co-requisite**), CHP3741 (Medicinal Chemistry I, prerequisite), CHP3721 (Drug Discovery and Development, **prerequisite)**

Course Descriptor**:** Disease targeting, Assay Systems and Models (e.g., Knock-out Mice); molecular modelling; stereoselective synthesis; structural analysis of drugs; combinatorial synthesis; physico-chemical aspects and principals of drug action; anti-infective agents; anti-viral agents; antibacterial agents; cardiovascular agents; case studies: drug and drug targets in the pathogenesis of selected infectious diseases (malaria, HIV/AIDS, tuberculosis) and non-infectious diseases (cancer).

CHB3862 INDUSTRIAL PHARMACEUTICAL BIOTECHNOLOGY

Course Title: **Industrial Pharmaceutical Biotechnology**
Course Code **CHB3862**
NQF Level 8
NQF Credits 8
Contact Hours: 2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
Continuous Assesment **(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite CHP3721 **(**Drug discovery and development), CHB3722 (Transmission of Genetic Information)

Course Descriptor: **Biotechnology and Medicine:** Diagnostics, Therapeutics, Gene Therapy, Implantates, Medical Devices, Technology, Complex Traits; **Molecular Pharma-Biotechnology,** Bioinformatics, Biological Systems and Models, Assay Systems, High-throughput Screening, Automation, Combinatorial Synthesis: Chemistry, Biology, and Biotechnology, Genotyping: Genetic Pre-Disposition, and Heterogeneity, Sequencing, Pharmaco-Genomics **Pharmaceutical Production:** GenePharming (Animals and Plants); Vitamins , Amino Acids, Proteins, Antibiotics, Biocatalysis, Natural Compounds, Recovery/(Bio-) Processing, Chemical–Biotechnological Syntheses, Gene Therapy Vectors/Systems, Production: Safety, Efficacy, Consistency, and Specificity, Registration; **Environment:** Pharmaceuticals and the Environment; Biological Containment; Physical/Chemical Containment, Process-Integrated Environmental Protection, Waste/Effluent Treatment and Recycling

CHN3842 HEALTH AND NUTRITIONAL BIOCHEMISTRY

Course Title: **Health and Nutritional Biochemistry**
Course Code **CHN3842**
NQF Level 8
NQF Credits 8
Contact Hours: 2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
Continuous Assesment **(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite Bioenergics and Metabolism (CHB3731), Medicinal Chemistry (CHP3741)

Course Descriptor**: The following topics are covered: Digestion and Abs**or**ption:** digestive tract, secretion of digestive materials, stimulation of digestive system, molecules important to digestion and absorption, digestion of biomolecules. **Nutrients that resist** or **escape digestion**: resistance of proteins to digestion, carbohydrates that escape digestion, dietary fibers, microorganisms and digestion, malabsorption syndromes. **Obesity**: types of fat, techniques for measuring fat, signaling pathways for regulating adipocyte formation and genetic factors in obesity. **Diet and Cancer**: cancer of the large bowel, genetic changes that result in cancer, RAS and MAP kinase signaling pathway, mutations in the RAS gene and cancer, Cadherin proteins and Epidemiology of diet and colon cancer, Vitamins and inorganic nutrients.

CHM3822 NATURAL PRODUCT CHEMISTRY II

Course Title:	**Natural Product Chemistry II**
Course Code	**CHM3822**
NQF Level	8
NQF Credits	8
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3752 (Organic Chemistry II); **Co-requisite:** CHM3801 (Instrumental Analysis II)
Contact Hours	2 lecture periods per week for one semester; 1 practical session per week for 7 weeks

Course Description: This is the continuation of natural products chemistry I. In this course, the student will be provided with sound knowledge on principles and techniques involved in the extraction and isolation of chemical constituents from natural sources and how to determine their structures. **Topics include:** classification of alkaloids; alkaloids derived from ornithine, lysine, tyrosine, and tryptophan; pseudoalkaloids; metabolites of mixed biosynthetic origin: metabolites derived from acetate and mevalonate; metabolites derived from shikimate and mevalonate; metabolites derived from acetate and shikimate; and metabolites derived from tryptophan and mevalonate. Extraction and purification of natural products: Phytochemical screening for different classes/groups of natural products. Bioassay-directed isolation of natural products. Determine the chemical structure of isolated compounds by applying IR, UV, one- and two-dimensional NMR and mass spectroscopy techniques.

CHB3842 BIOTECHNOLOGY, MICRO AND NANOTECHNOLOGY

Course Title:	**Biotechnology, Micro and Nanotechnology**
Course Code	**CHB3842**
NQF Level	8
NQF Credits	8
Contact Hours:	2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final:** 50% CA mark and **50%** Examination mark.
Prerequisite	Transmission of Genetic information (CHB3722)

Course Descriptor**:** Introduction to "omics"; **Genomics**: techniques-genomic libraries and analysis, southern blots, applications. **Proteomics:** definitions, concepts of protein expression and analysis, Techniques-SDS PAGE gels, Western blots, applications. **Transcriptomics:** definitions, Techniques- cDNA libraries and analysis, Northern blots, applications. **Metabolomics:** Techniques-metabolic pathways and analysis. **Cytomics**: Biochemical processes at the cellular; **Agricultural Biotechnology:** Technology Studies: Pesticide producing crops; Herbicide-tolerant transgenic crops; Insect-resistance transgenic crops. **Micro- and Nanotechnologies for Medicine**: Scope, principles and techniques of nanotechnology; preparation of nano particles and their properties, application of nanotechnology in biotechnology: Oligonucleotide microarray, 'lab-on-a-chip' nanocomposites; Cellular Cloning; Tissue Engineering (Organ Cultivation); **Food Biotechnology:** Enzyme application in food and feed; probiotics - prebiotics and nutraceuticals.

CHM3802 INOR**GANIC CHEMISTRY III**

Course Title:	**Inorganic Chemistry III**
Course Code	**CHM3802**
NQF Level	8
Contact Hours:	2 lecture periods per week for one semester and 1 practical session per week for 7 weeks
NQF Credits	8
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3751 (Inorganic Chemistry II), CHM3752 (Organic Chemistry II)

Course Descriptor**:** Organometallic chemistry: organometallic compounds of d block elements with emphasis to iron complexes; Physical and chemical properties of organometallic compounds; Reactivity of coordinated cyclopentadienyl and cyclobutane ligands. Transition metal carbonyls: metal clusters, bonding and synthesis; Catalysis involving organometallic compounds.

CHM3812 INDUSTRIAL CHEMISTRY II

Course Title:	**Industrial Chemistry II**
Course Code	**CHM3812**
NQF Level	8
Contact Hours	4 lecture periods per week for one semester and 1 practical session per week for one semester
NQF Credits	16
Continuous Assesment	**(**minimum of three tests which counts 80% and laboratory component 20%).**Examination:** 1x3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3712 (Physical Chemistry II); CHM3761 (Industrial Chemistry I)

Course Descriptor**: Petroleum industry:** technologies and equipments of producing petrochemicals including ethylene, propylene, aromatics. **Fluid mechanics:** fluid statics and its applications; fluid-flow phenomena; Basic equations of fluid flow; Flow of incompressible fluids in conduits and thin layers; Flow past immersed bodies; transportation of fluid. **Heat transfer and its applications:** heat transfer by conduction in solids; principles of heat flow in fluids; heat transfer to fluids without phase change; heat transfer to fluids with phase change; radiation heat transfer; heat-exchange equipment and its applications. **Mass transfer and its applications:** equilibrium-stage operations; distillation: flash distillation, continuous distillation, operating lines, design and operating characteristics of plate columns, enthalpy balances for fractionating columns.

CHC3832 CHEMICAL XENOBIOTICS & TOXICOLOGY

Course Title:	**Chemical Xenobiotics & Toxicology**
Course Code	**CHC3832**
NQF Level	8
NQF Credits	16
Contact Hours	4 lectureperiods per week; 1 practical session per week forone semester
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%). **Examination:** 1x3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHP3701 (Water Analysis), CHP3711 (Environmental Chemistry I)

Course Descriptor: this module is designed to study the interactions between environmental contaminants and living organisms. It looks at the behavior of xenobiotics into living organisms particularly the biotransformation reactions and reactive species formation and it also looks at the effects that chemical xenobiotics can cause on biological processes.

Content: Chemical Xenobiotics: Classification and behavious. Bioaccumulation and biomagnification of xenobiotics. Behavior of xenobiotics into living organisms: absorption, distribution, biotransformation, toxic effects and elimination. The fate and impact of synthetic and natural molecules in the environment. Important pollutants will be used as case studies to illustrate the principles. Principles of toxicology; chemical and biochemical mechanism; pesticide toxicity. Analysis of specific health and environmental impact of hazardous waste.

CHC3822 Petroleum Chemistry

Course Title:	**Petroleum Chemistry**
Course Code	**CHC3822**
NQF Level	8
NQF Credits	8
Contact Hours	2 lectureperiods per week; 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of two tests which counts 80% and laboratory component 20%).**Examination:** 1x2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHM3752 (Organic ChemistryII), CHM3761 (Industrial Chemistry I), CHM3712 (Physical Chemistry II)

Course Descriptor**: Introduction:** native materials and classification, properties and fractional composition. **Petroleum analysis**: structure of petroleum; physical, thermal, electrical, optical, spectroscopic, chromatographic and molecular methods. **Refining processes**: dewatering and desalting, thermal methods, catalytic methods, reforming, isomerization, alkylation and polymerization processes. **Cracking processes**: thermal cracking, catalytic cracking, hydrocracking. **Distillation**: equipment and calculation. **Product improvement**: deasphalting and dewaxing, hydrotreatign and desulfurization, reforming and isomerization, petrochemical. **Applications of Nano technology in Petroleum industry.**

CHM3880 RESEARCH METHODOLOGY & PROJECT

Course Title:	**Research Methodology & Project**
Course Code	**CHM3880**
NQF Level	8
Contact Hours:	2 consultation periods per week for one semester
NQF Credits	38
Continuous Assessment	1 Oral presentation counts 30%, Consultation and efforts counts 20%, 1 Project report counts 50% **Final: 100%** CA
Prerequisite	Pass in all level 7 modules

Course Descriptor: An independent project carried out in small groups, under the supervision of a member of staff. Topics will be given to students before the end of the first semester. The work will extend over the term and as a guide, should occupy the equivalent of one whole day per week. The practical work must be completed by six weeks before the session ends and must be submitted by two weeks before the session end. The completed report is expected to be between 25-35 pages long and will be examined by the supervisor and one external examiner and will be defended by an oral exam. There shall be a short, block-course based, where the essentials of Research Methodology will be taught.

H.1.16 CHEMISTRY MODULE EQUIVALENTS

OLD MODULE		NEW/REVISED MODULE	
CHM3511	Chemistry IA	CHM3511	Chemistry IA
CHM3512	Chemistry IB	CHM3512	Chemistry IB
CHM3611	Inorganic Chemistry I	CHM3611	Inorganic Chemistry I
CHM3631	Physical Chemistry I	CHM3631	Physical Chemistry I
CHB3611	Biochemistry I	CHB3612	Biomolecules and Catalysis
CHM3602	Analytical Chemistry I	CHM3602	Analytical Chemistry I
CHM3612	Organic Chemistry I	CHM3651	Organic Chemistry I
CHB3612	Biochemistry II	CHB3612	Biochemistry II
CHM3701	Inorganic Chemistry II	CHM3751	Inorganic Chemistry II
CHM3711	Organic Chemistry II	CHM3752	Organic Chemistry II
CHM3721	Analytical Chemistry II	CHM3721	Analytical Chemistry II
CHM3761	Industrial Chemistry I	CHM3761	Industrial Chemistry I
CHM3702	Instrumental Analysis I	CHM3702	Instrumental Analysis I
CHM3712	Physical Chemistry II	CHM3712	Physical Chemistry II
CHB3701	Biochemistry III	CHB3722	Transmission of Genetic Information
CHM3722	Research Methodology	CHM3722	Research Methodology
CHM3811	Organic Chemistry III	CHM3811	Organic Chemistry III
CHM3831	Physical Chemistry III	CHM3831	Physical Chemistry III
CHM3801	Instrumental Analysis II	CHM3801	Instrumental Analysis II
CHM3812	Industrial Chemistry II	CHM3812	Industrial Chemistry II
CHB3822	Natural Product Chemistry II	CHB3822	Natural Product Chemistry II
CHB3821	Natural Product Chemistry I	CHB3821	Natural Product Chemistry I
CHM3802	Inorganic Chemistry III	CHM3802	Inorganic Chemistry III
CHM3810/CHB3810	Research Projects	CHM3810/ CHB3810	Research Projects
CHM3841	Physical Inorganic Chemistry		No equivalent
CHM3842	Advanced Topics in Chemistry		No equivalent
CHM3832	Molecular Spectroscopy	CHM3832	Molecular Spectroscopy
CHB3732	Medical Biochemistry	CHB3732	Medical Biochemistry
CHB3801	Nutritional Biochemistry	CHB3801	Nutritional Biochemistry
CHB3831	Bioinformatics for Biochemistry	CHB3831	Bioinformatics for Biochemistry
CHB3832	Professional Training in Biochemistry		NONE
CHB3812	Environmental Biochemistry	CHB3812	Environmental Biochemistry
CHB3852	Advanced Topics in Biochemistry		NONE

H.1.17 SERVICE COURSES

CHM 3532 Chemistry for Life Sciences

Course Title:	**Chemistry for Life Sciences**
Course Code	**CHM3532**
NQF Level	5
NQF Credits	16
Contact Hours	4 lecture periods per week; 1 practical session per week for one semester
Continuous Assesment	(minimum of 3 tests which counts 75% and laboratory component 15%).**Examination:** 1 x 3hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	Faculty Entry Requirements

Course Descriptor: This course is designed for students that have insufficient background in chemistry and for non-chemistry majors .It is an introduction to topics in general and organic chemistry, and biochemistry. The following will be covered:
Classification of Matter: Mixtures and Pure substances; Physical States of Matter; Physical and Chemical Properties. Extensive and Intensive properties. Measurements: Units, Significant figures; Precision and Accuracy, Factor Label Method. Atomic structure and the Periodic table; Electron configuration; Physical and Chemical properties as predicted from groups. Ionic compounds and Molecular compounds: Writing chemical formulae and naming of ionic and molecular compounds. Average Atomic Mass. The Mole Concept; Percent Composition, Empirical formula and Molecular formula. Stoichiometry: limiting reagent, percent yield. Solutions: electrolytes and nonelectrolytes, aqueous solutions, ionic equations; concentrations: percent concentration; molarity, molality; dilution of solutions; structure and solubility. Types of bonds; Lewis structures; Resonance structures; Molecular geometry: the VSEPR model, Polarity of molecules. Acid-base equilibrium: properties of acids and bases; relations of acids and bases, self ionisation of water; strengths of acids
and bases; the pH scale; hydrolysis of salts; buffers; acid-base titration. Introduction to organic chemistry: organic compounds; structural formulae and conformations; functional groups; Classes of hydrocarbons: alkanes, cycloalkanes: alkanes; alkenes and alkynes; oxidation and reduction; addition reactions; stereo-isomerism. Alcohols, phenols, thiols, ethers: organic compounds of oxygen; common alcohols and phenols. Carboxylic acids and esters, amines and amides: Introduction to carbohydrates, lipids and porphyrins.

CHE 3742 Inorganic Chemistry for Educators I

Course Title:	**Inorganic Chemistry for Educators I**
Course Code	**CHE 3742**
NQF Level	7
NQF Credits	16
Contact Hours	4 lecture periods per week; 1 practical session per week for one semester
Continuous Assesment	(minimum of 2 tests which counts 80% and laboratory component 20%).**Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	PHY 3511 (Physics for Physical Sciences 1), PHY 3512: (Physics for Physical Sciences 2), PHY 3651(Mechanics and Waves), MAT 3511(Basic Mathematics) and MAT 3512 (Precalculus).

Course Descriptor: This course covers the chemistry of transition metals. This means the student would have been equipped with adequate background from the chemistry of main group elements. With such a background the student will be in a position to follow the chemistry of transition metals. The following topics will be covered: The brief introduction to the chemistry of alkali and alkaline earth elements (groups 1 and 2); reactivity with hydrogen, oxygen, halogens, water, and liquid ammonia; Classification of oxides, and their reaction with water; Pblock elements (groups 13 to 18): Reactivity with oxygen and halogens; The hydrides of P block elements; Hydrolysis and ammonolysis of P-block halides. Delocalized multiple bonding. S-block elements. In-depth studies of chemical bonding (valence bond theory (VBT), shapes of molecules and hybridization, molecular orbital theory (MOT) in diatomic and polyatomic molecules) and Bonding-Application of VBT; CFT; LFT, MOT; Introduction to transition metal chemistry (d-block elements): transition metal complexes (constitution, nomenclature, isomerism, classification of ligands); Reaction Mechanisms and rate of reactions; Ligand substitution; Dissociative and Associative mechanisms; redox and photochemical reactions in transitional complexes; Molecular symmetry: symmetry elements; plane of symmetry; proper and improper axes; principal axis; point of inversion; classification of molecules into point groups. Introduction to organometallic chemistry of s-block elements (magnesium and lithium).

CHE 3862 Inorganic Chemistry for Educators II

Course Title:	**Inorganic Chemistry for Educators II**
Course Code	**CHE 3862**
NQF Level	8
NQF Credits	8
Contact Hours	2 lecture periods per week; 1 practical session per week for 7 weeks
Continuous Assesment	**(**minimum of 2 tests which counts 80% and laboratory component 20%).**Examination:** 1 x 2hr examination; **Final: 50%** CA mark and **50%** Examination mark.
Prerequisite	CHE 3742 (Inorganic Chemistry for Educators 1)

Course Descriptor: This course deals with the organometallic chemistry which is a hybrid discipline comprising the knowledge of inorganic and organic chemistry. The following topics will be covered:
Organometallic chemistry: organometallic compounds of d block elements with emphasis to iron complexes; Physical and chemical properties of organometallic compounds; Reactivity of coordinated cyclopentadienyl and cyclobutane ligands. Transition metal carbonyls: metal clusters, bonding and synthesis; Catalysis involving organometallic compounds. Chemistry of f-block elements; Nuclear Chemistry.

CHE3622 Organic Chemistry for Educators

Course Title:	**Organic Chemistry for Educators**
Course Code:	**CHE3622**
NQF Level:	8
NQF Credits:	8
Continuous Assessment:	50% (minimum 2 tests, 80%; laboratory component 20% Examination 50%: (1 x 2 hour paper)
Prerequisite:	CHM3511 (Chemistry 1A), CHM3512 (Chemistry 1B)
Contact Hours:	2 lecture periods per week for 13 weeks, 1 practical session for 7 weeks

Course Description: This course is a survey of the chemistry of carbon compounds, their nomenclature, physical properties, structure and reactions with an introduction to reaction mechanisms and stereochemistry. The following topics will be covered: Alkanes and cycloalkanes: nomenclature, physical properties, bond rotation, conformations, ring strain, bicyclic and polycyclic alkanes, synthesis and reactions of alkanes; Alkenes and alkynes: physical properties and synthesis (Zaytsev's Rule), addition reactions: nucleophilic substitutions, elimination reactions; Radical reactions: free radicals, halogenation of alkanes, chain reactions; Stereochemistry: stereoisomers, enantiomers, chirality, diastereomers, meso compounds, optical activity. Alkyl halides: physical properties, synthesis, reactions; Alcohols and ethers: physical properties, synthesis, reactions

H.1.18. BSC IN CHEMISTRY (HONOURS) 11BSAC (ARTICULATION) PROGRAMME

H.1.18.1. PURPOSE AND RATIONALE OF THE QUALIFICATIONS

The purpose of this qualification is to provide an opportunity for holders of level 7 NQA degrees in Chemistry/Biochemistry or pre-NQF BSc degree in Chemistry/Biochemistry to upgrade to NQA level 8 honours degree. This programme will provide students with knowledge, skills and competence in the science of Chemistry and Biochemistry at BSc NQF Level 8 in order to develop Namibia's own human resources and capacity in Chemistry and Biochemistry.

Graduates of the Chemistry programme will contribute towards the social and economic development of the country through their participation in entrepreneurship or employment in the education, public or private sectors especially in fields like Forensics, Medicine, etc. where a balanced Chemistry knowledge is important.

For Biochemistry students, this program will facilitate students' progression towards fulfilling and exciting careers in academia, industry (food, beverage and diagnostic), and/or government and also to develop their skills as future leaders in science and society

The programme is in line with UNAM's mission "To provide quality higher education through teaching, research and advisory services to our customers with the view to produce productive and competitive human resources capable of driving public and private institutions towards a knowledge-based economy, economic growth and improved quality of life."

H.1.18.2. ADMISSION REQUIREMENTS

The applicant must be in a possession of either

a) a BSc degree in Chemistry/Biochemistry at NQL level 7.

Or

b) Pre-NQF BSc degree in Chemistry/ Biochemistry or any equivalent qualification from a recognized institution.
c) Students who have completed double major BSc degree maybe required to register for a number of undergraduate modules for non-degree purposes in order to gain admission into this programme.

H.1.18.3. ASSESSMENT CRITERIA

A combination of continuous assessment (50%) and an examination (50%) will be used to assess each of the typical modules in this program and details are further specified under respective modules. The minimum CA mark that will allow entrance into the examination is 50% and the minimum final mark of 50% is required for a pass. Assessment criteria are based on written examinations, written tests, assignments, laboratory practicals, research reports, oral examinations, and seminar presentations. Attendance of lectures and practical classes is compulsory (at least 80%).

H.1.18.4. MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE FACULTY

To be re-admitted to the Faculty of Science for a second year of registration, a student must have passed a minimum of 64 credits by the end of the first year.

H.1.18.5. ADVANCEMENT AND PROGRESSION RULES

Not applicable as this is a one-year programme.

H.1.18.6. DURATION OF STUDY

The minimum duration of the study is one year and the maximum is two years for full-time students and three (3) years for part-time students. Relevant committees may grant an extension of registration up to six (6) months beyond the stipulated period if valid reasons are advanced.

H.1.18.7. REQUIREMENTS FOR QUALIFICATION AWARD

This qualification will be awarded to candidates who have cleared all prescribed modules as indicated in the curriculum framework.

H.1.18.8. EXEMPTIONS

UNAM will give exemptions for equivalent courses taken at other tertiary institutions but the exemptions shall not exceed 50% of the programme in line with the General Information and Regulations Prospectus.

H.1.18.9. CLASS ATTENDANCE

In order to be admitted to examinations, students are required to attend at least 80% of the lectures and to complete the required elements that make up the continuous assessment mark. Hundred percent attendances of practical classes are required.

H.1.19. BACHELOR OF SCIENCE IN CHEMISTRY HONOURS 11BSAC

TABLE FOR ALL MODUELS IN BSC IN CHEMISTRY HONOURS 11BCAC

SEMESTER	COURSE NAME	COURSE CODE	CREDITS	PRE-REQUISITE	CO-REQUISITE
1	Instrumental Analysis II	CHM3801	8	CHM3702	none
1	Organic Chemistry III	CHM3811	16	CHM3752	none
1	Physical Chemistry III	CHM3831	16	CHM 3631; MAT3611	none
1&2	Research Methodology & Project	CHM3880	38	Pass in all level 7 modules	none
1	Wastewater Treatment (Elective)	CHP3811	16	CHP3701, CHP3711	none
1	Natural Product I (Elective)	CHM3821	8	CHM3752, CHM3702	None
2	Industrial Chemistry II	CHM3812	16	CHM3712 CHM3761	none
2	Inorganic Chemistry III	CHM3802	8	CHM3751, CHM3752	none
2	Natural Product Chemistry II	CHM3822	8	CHM3752	CHM3801
2	Petroleum Chemistry (Elective)	CHC3822	8	CHM3752, CHM3761 & CHM3712	none
2	Environmental Chemistry II (Elective)	CHP3822	8	CHP3711	none
2	Medicinal Chemistry II (Elective)	CHP3842	8	CHP3741, CHP3721	CHM3811
Total Credits			**126**		

H.2. MSC PHYSICS (11MSPH)

This master's programme in Physics has been **fully accredited** by the Namibian Council for Higher Education (NCHE) for a period of 6 years.

H.2.1. REGULATIONS

H.2.1.1. ADMISSION REQUIREMENTS

The admission requirement for this **fully accredited** master programme in Physics is a University of Namibia NQF Level 8 degree in Physics or equivalent degree from a recognised institution. The applicant will be accepted based on his/her undergraduate academic record with an average mark of at least **60%**.

H.2.1.2. DURATION OF STUDY

The duration of this programme will be two (2) years minimum and three (3) years maximum for full-time students. The first year will mostly consist of coursework, while the second year will be dedicated to a supervised research project and the writing of a thesis.

H.2.1.3. CURRICULUM COMPILATION

YEAR 1

CODE	COURSE NAME	NQF LEVEL	CREDIT	PREREQUISITE	Compulsory/ Elective	COREQUISITES
Year 1 Semester 1						
PHY5911	Advanced Quantum Mechanics	9	24	None	Compulsory	None
PHY5951	Mathematical Methods of Physics	9	24	None	Compulsory	None
UAE5819	Advanced Academic Writing for Postgraduate Students	9	NCB	None	Compulsory	None
PHY5920	Research Methodology and Project Proposal	9	24	None	Compulsory	None
Year 1 Semester 2						
PHY5912	Lasers and Applications	9	24	None	Elective	None
PHY5932	Radiation Physics	9	24	None	Elective	None
PHY5952	Computational Physics	9	24	None	Elective	None
PHY5972	Advanced Classical Mechanics	9	24	None	Compulsory	None
PHY 5992	Astro- and Space Physics	9	24	None	Elective	None
Total credits			**144**			

YEAR 2

CODE	COURSE NAME	NQF LEVEL	CREDIT	PREREQUISITE	Compulsory/ Elective	COREQUISITES
PHY5900	Thesis	9	120	**All** Year 1 subjects passed	Compulsory	None
Total credits			**120**			

Total credits = 144 (year 1) + 120 (year 2) = 264
NCB = Non-Credit Bearing

H.2.1.4. EXAMINATION REGULATIONS

Formal examinations, subject to external moderation, will take place at the end of each semester of the first year of the programme. A minimum continuous assessment mark of 40% and a minimum of 80% class attendance is required to be admitted to write the examination in a specific course. Students must pass all courses to proceed to the thesis component of the degree. In all cases, a minimum mark of 50% is required to pass.

H.2.1.5. FORMAT AND EVALUATION OF THESIS WORK

During the thesis year, the student shall conduct supervised research in a Senate approved field of study. At the end of this year, the candidate must submit a completed Master Thesis/Dissertation in the English language. This thesis must be in a format prescribed by the Department as per University regulations. The completed thesis will be evaluated by the supervisor(s) and one (or more, if needed) external examiners, normally within a month after submission. The student will be expected to successfully defend his/her thesis in a viva voce examination.

H.2.1.6. PRACTICALS

Attendance of practical classes, experiments, projects, field trips and/or internships as prescribed by the course lecturers and thesis supervisor(s) are compulsory.

H.2.2. COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

FIRST YEAR COURSES

PHY5911: ADVANCED QUANTUM MECHANICS

Course title: **ADVANCED QUANTUM MECHANICS**
Code: **PHY5911**
NQF level: 9
Contact hours: 4 hours per week for 1 semester and 36h of practical work or a mini project
Credits: 24
Course assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites: None

Course description: Review of time independent perturbation theory: Non-degenerate case - First order correction to energy and corresponding wave function, second order correction to energy and corresponding wave function, applications; Time independent perturbation theory: Degenerate case - Applications to first order Stark effect and to the normal Zeeman effect; Variational principle: Principle and applications to the ground state of hydrogen and helium atoms; Wentzel-Kramers-Brillouin (WKB) approximation: Development and applications of the WKB approximation: Probability of penetration of a barrier, theory of a- decay, Geiger-Nuttel law, potential-well; Time-dependent perturbation theory (method of variation of constants) : Zero and first order perturbation calculations, adiabatic approximation, Fermi-golden rule, sudden approximation, harmonic perturbation, applications - a charge particle in an electromagnetic field, semi-classical theory of radiation, Einstein's transition probabilities; Scattering theory: Scattering cross-section, Greens function approach, Born approximation, partial wave analysis; Relativistic quantum mechanics: Klein-Gordon equation, Klein-Gordon with external electromagnetic potentials, bilinear covariants, solution of the Dirac equation for free particles, plane waves, projection operators, relativistic hydrogen atom; Elements of second quantization: Introduction, canonical quantization of fields, second quantization of Schrodinger field, systems of bosons, system of fermions, creation and annihilation operators.

PHY5920: RESEARCH METHODOLOGY AND PROJECT PROPOSAL

Course title: **RESEARCH METHODOLOGY AND PROJECT PROPOSAL**
Code: **PHY5931**
NQF level: 9
Contact hours: 2 hours per week for 2 semesters
Credits: 24
Course assessment: Continuous Assessment (**100%**) Continuous assessment will consist of reports son various topics and, most importantly, a well developed project proposal for his/her M.Sc. thesis.
Pre-requisites: None

Course description: Philosophical underpinnings of the Scientific Method, Fallacies of Reason & Rhetoric, aviding "bad science" and pseudoscience, ethical and legal issues, statistical and mathematical principles, error analysis and propagation, hypothesis verification/refutation, the IOP referencing style and citation; Logic and the taxonomy of the Fallacies of Rheason & Rhetoric, philosophical streams in the Philosophy of Science and overview of modern philosophers like Russell, Popper and Kuhn; Library resource utilization, mini literature reviuew projects in prospective fields of research, identification of supervisor(s), writing and presentation of a draft Research Proposal.

PHY5951: MATHEMATICAL METHODS OF PHYSICS

Course title: **MATHEMATICAL METHODS OF PHYSICS**
Code: **PHY5951**
NQF level: 9
Contact hours: 4 hours per week for 1 semester and 36h of practical work or a mini project
Credits: 24
Course assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites: None

Course description: Tensors - tests for tensor character, types of tensors, operations with tensors, compressed notation. Complex analysis - complex variable functions; continuity and differentiability of complex variable functions; Cauchy-Riemann equations; analytic functions; sequences and series; Boltzano-Weierstrass theorem; differentiability of the sum of a power series; integral of complex variable functions; properties of integrals; paths, piecewise continuous paths; path integral; analytical continuation; elementary functions of complex variables as analytic continuations of functions of real variables; Cauchy integral theorem, Cauchy integral formula; Liouville's theorem; fundamental theorem of algebra; singularities; Lauren series; residue; residue theorem; conformal mappings; applications of conformal mappings; basics of operational calculus. Special functions - Legendre, Laguerre, Hermite, Jacobi, Bernoulli, Chebishev polynomials, Bessel functions, hypergeometric function, degenerate hypergeometric function, Beta function, Riemann zeta function; boundary conditions problems - harmonic functions, harmonic analysis. PDEs - parabolic, hyperbolic, elliptic; boundary conditions problems - Green function, Sturm-Liouville problem, eigenvalues, eigenfunctions.

UAE5819: ACADEMIC WRITING FOR POSTGRADUATE STUDENTS

Course title: **ACADEMIC WRITING FOR POSTGRADUATE STUDENTS**
Code: **UAE5819**
NQF level: 9
Contact hours: 4 hours per week for 1 semester and 36h of practical work or a mini project
Credits: 24 (NCB)
Course assessment: Continuous Assessment 1 x 3-hour Exam Paper Continuous Assessment may consist of a combination of tests, practicals and/or assignments.Subminima of 40% are required in both the continuous assessment and examination.
Pre-requisites: M.Sc. admission requirements
Course description: This course is a post-graduate course designed to empower students with skills and knowledge to access and critique academic sources and to synthesize information from these sources to assist them in the substantiation and development of their own claims when writing an academic paper in their respective fields of specialization. Additionally, this course will empower students with the capacity to undertake the challenges of academic writing by exposing them to the different rhetorical and stylistic elements typical of academic texts. Finally, students will be introduced to the American Psychological Association (APA) writing style and will be equipped with the necessary skills to format an academic paper in APA style.

PHY5912: LASERS AND APPLICATIONS

Course title: **LASERS AND APPLICATIONS**
Code: **PHY5912**
NQF level: 9
Contact hours: 4 hours per week for 1 semester and 36h of practical work or a mini project
Credits: 24
Course assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**) Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites: None
Course description: Review of Atomic Physics: Hydrogen atom, excited states of hydrogen, wave nature of particles, particle nature of light, angular momentum of atoms, one electron atoms, multiple electron atoms, Radiative transitions: Einstein's A and B coefficients, population, inversion, gain, and gain saturation, threshold frequencies, laser oscillation above threshold, laser amplifiers, laser resonators, two level systems, three level systems, and four level laser systems, Characteristics of laser radiations: Coherence, monochromaticity, directionality and brightness, broadening and line width, homogeneous and inhomogeneous broadening, energy levels, radiative properties of materials, solid, liquid and dye molecules, radiation and thermal equilibrium,
Cavity radiations: transverse and longitudinal modes, laser pumping and laser cavities, cavity designs, cavity modes, cavity effects, stable laser resonators, Q switching, mode locking, mode dumping, frequency multiplication, frequency stabilization, Laser systems: atomic gas lasers, molecular gas lasers, solid state lasers, semiconductor lasers, free-electron lasers, chemical lasers, dye lasers, ring lasers. Applications: calibration of meters, distance measurement, entertainment, distortion measurements, guidance, material processing, machining, cutting, welding, cladding, hardening, defence applications, medical applications, applications in agriculture and earth sciences, applications in telecommunications, laser spectroscopy

PHY5932: RADIATION PHYSICS

Course title: **RADIATION PHYSICS**
Code: **PHY5932**
NQF level: 9
Contact hours: 4 hours per week for 1 semester and 36h of practical work or a mini project
Credits: 24
Course assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites: None
Course description: Review of atomic and nuclear structures, atomic and nuclear radiation, classification of radiation, natural and man-made sources of radiation; Interaction of heavy charged particle with matter: Maximum energy transfer, stopping power, range; Interaction of beta particles with matter: Collisional stopping power, radiative stopping power, radiation yield, range; Interaction of photon with matter; Neutron interaction with matter: elastic scattering, capture process, fission; Methods of radiation detection: Ionization in gases, gas-filled detectors, Scintillation and semiconductor detectors, neutron detectors; Radiation dosimetry: exposure, absorbed dose, dose equivalent, measurement of exposure – free air ionization chamber, air-wall chamber – measurements of absorbed dose, X-ray and gamma ray dose, neutron dosimetry, dose calculations; Radiation hazards and effects: direct and indirect radiation, chemical and biological effects, the acute radiation syndrome, somatic effects – stochastic and nonstochastic; External radiation protection: Distance, time and shielding, gamma-ray shielding, protection from beta radiation, neutron shielding; Applications of different types of radiation: Industrial, medical, scientific, environmental pollution, geological.

PHY5952: COMPUTATIONAL PHYSICS

Course title: **COMPUTATIONAL PHYSICS**
Code: **PHY5952**
NQF level: 9
Contact hours: 4 hours per week for 1 semester and 36h of practical work or a mini project
Credits: 24
Course assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites: None
Course description: NUMERICAL SOLUTIONS OF ODES: Generalizations of the Euler method; Runge-Kutta methods; Linear multistep methods; Predictor-Corrector methods; Adams-Moulton method; FINITE DIFFERENCES AND FINITE DIFFERENCE METHODS: Forward, backward

and central derivatives; Numerical "stencils"/Computational "molecules"; Grid transformations; MATRIX INVERSION METHODS: Gauss elimination; Techniques for sparse matrices: Iterative methods; the Thomas algorithm; Eigenvalue problem; NUMERICAL SOLUTION OF PDEs: Classification of PDEs (parabolic, elliptical, hyperbolic); Methods for frequently occurring PDEs in Physics: Crank-Nicolson, ADI, LOD; Applications: heat, diffusion, diffusion-convection, wave and poison equations; STOCHASTIC (MONTE CARLO) METHODS: Random number generators; Random walk & random flights; Statistical fundamentals; Sampling from spectra; Successive over-relaxation, Hybrid MC method; Applications.

PHY5972: ADVANCED CLASSICAL MECHANICS

Course title:	**ADVANCED CLASSICAL MECHANICS**
Code:	**PHY5972**
NQF level:	9
Contact hours:	4 hours per week for 1 semester and 36h of practical work or a mini project
Credits:	24
Course assessment:	Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**) Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites:	None

Course description: SURVEY OF ELEMENTARY PRINCIPLES: Mechanics of a particle and a system of particles; Constraints; D'Alembert's principle and Lagrange's equations; Velocity-dependent potentials and the dissipation function; Simple applications of the Lagrangian formulation; VARIATIONAL PRINCIPLES AND LAGRANGE'S EQUATIONS: Hamilton's principle; Calculus of variations; Derivation of Lagrange's equations from Hamilton's principle; Extension to nonholonomic systems; Conservation theorems; RIGID BODY MOTION: Euler angles; Caley-Klein parameters; Euler theorem on the motion of a rigid body; Finite and infinitesimal rotations; Coriolis force; Tensors and dyadics; Inertia tensor; Applications; SPECIAL RELATIVITY IN CLASSICAL MECHANICS: Lorentz transformations in real 4 dimensional spaces; Covariant 4 dimensional formulations; Force and energy equations in relativistic mechanics; Lagrangian formulation of relativistic mechanics; Covariant Lagrangian formulations; HAMILTON EQUATIONS OF MOTION: Legendre transformations and the Hamilton equations of motion; Cyclic coordinates and conservation theorems; Hamiltonian formulation of relativistic mechanics; Derivation of Hamilton's equations from a variational principle; The principle of least action; CANONICAL TRANSFORMATIONS: Equations of canonical transformations; Sypmplectic approach to canonical transformations; Poisson brackets and Poisson bracket formulation of mechanics; Liouville's theorem; LAGRANGIAN AND HAMILTONIAN FORMULATIONS FOR CONTINUOUS SYSTEMS AND FIELDS: Transition from discrete to continuous systems; Lagrangian formalism for continuous systems; Stress tensor; Hamiltonian formulation, Poisson brackets and momentum representation; Relativistic field theory; Noether's theorem.

PHY5992: ASTRO- AND SPACE PHYSICS

Course title:	**ASTRO- AND SPACE PHYSICS**
Code:	**PHY5992**
NQF level:	9
Contact hours:	4 hours per week for 1 semester and 36h of practical work or a mini project
Credits:	24
Course assessment:	Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**) Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites:	None

Course description: COSMIC RAYS: Properties of Cosmic Rays; Distribution functions, intensities, energy and mass spectra; Second order Fermi-acceleration; DIFFUSIVE SHOCK ACCELERATION: Astrophysical magnetohydrodynamic shocks; Rankine-Hugoneot relations; Compression ratios and derived properties of astrophysical shocks; First order Fermi-acceleration; Diffusive shock acceleration; DIFFERENTIAL TRANSPORT AND MODULATION THEORY: The Heliosphere; Solar and stellar winds; Termination shock and Heliopause; Interplanetary magnetic field; Parker spiral field and the neutral sheet; Derivation of Parker transport equation from Boltzmann equation; Particle and current sheet drift; The diffusion tensor; Cosmic ray modulation; Anomalous cosmic rays and acceleration at the solar wind termination shock; RADIATIVE PROCESSES: Synchrotron radiation; Compton and inverse Compton effects; Inverse Compton collision cross sections: Thompson and Klein-Nishina; Synchrotron-self-Compton processes; Photon-photon collisions; REVISION OF ASTROPHYSICAL BASICS: Stellar Physics; Stellar Evolution; Star Formation;Stellar Remnants & Degenerate objects:white dwarfs & neutron stars; Pulsars, Plerions and Supernova Remnants; Black Holes;THE MILKY WAY AND OTHER GALAXIES: Structure of the Milky Way; Galaxy Demographics; Active Galactic Nuclei and Quasars; Groups & Clusters of Galaxies. BIG BANG COSMOLOGY: Olbers' Paradox; Extragalactic Distances; Hubble's Law; Cosmic Clocks; Isotropy; The Friedmann-Robertson-Walker Metric; The Friedmann Equations; The Future of the Universe; Light Element Nucleosynthesis; Tests of Big Bang Cosmology: cosmological redshift & Hubble's Law, the cosmic microwave background, quasars as cosmological probes

SECOND YEAR COURSE

PHY5900: THESIS

Course title:	**THESIS**
Code:	**PHY5900**
NQF level:	9
Contact hours:	N/A
Credits:	120
Course assessment:	Thesis to be submitted at the end of the year for internal and external examination.
Pre-requisites:	All courses of the first year must be completed.

Course description: The student will be required to undertake research activities in a selected topic of Physics and to submit a thesis. Students will work under the supervision of a researcher of their own choice which will enable the candidate to gain theoretical and analytical knowledge in course work to a substantive problem relevant to their area of specialization.

H.3. MSC NUCLEAR SCIENCE (11MSNU)

H.3.1. REGULATIONS

H.3.1.1. ADMISSION REQUIREMENTS

The admission requirement for the MSc in Nuclear Science programme will be a NQF Level 8 degree or its equivalent with major in Physics or Chemistry or Mathematics and with one of the following disciplines on at least a second-year level: Chemistry, Mathematics, Physics, Geology and Computer Science (but excluding Mathematics/Computer Science and Mathematics/Geology combinations). The applicant will be accepted based on his/her undergraduate academic record with an average mark of 60%.

H.3.1.2. DURATION OF STUDY

The duration of this programme will be two (2) years minimum and three (3) years maximum. The first year will mostly consist of coursework, while the second year will be dedicated to a supervised original research project and the writing of a thesis.

H.3.1.3. CURRICULUM COMPILATION

The curriculum for the MSc in Nuclear Science consists of coursework and the writing of a research thesis. Please refer to the Postgraduate Student Guide from the School of Postgraduate Studies, and the General Prospectus: Information, Regulations & Fees.
QUALIFICATION: Master of Science IN Nuclear Science (11MSNU)

YEAR 1

CODE	COURSE NAME	NQF LEVEL	CREDIT	PREREQUISITE	Compulsory/ Elective	COREQUISITES
Year 1 Semester 1						
NUC5911	Principles of Nuclear Physics	9	24	None	Compulsory	None
NUC5901	Nuclear Instrumentation	9	12	None	Compulsory	None
NUC5921	Mathematical Methods for Nuclear Scientists	9	12	None	Compulsory	None
UAE5819	Academic Writing for Postgraduate Students	9	NCB	None	Compulsory	None
PHY5920	Research Methodology and Project Proposal	9	24	None	Compulsory	None
Year 1 Semester 2						
NUC5912	Nuclear Chemistry	9	24	None	Compulsory	None
NUC5932	Radiation Protection and Health Physics	9	24	None	Compulsory	None
NUC5902	Radiobiology	9	12	None	Compulsory	None
NUC5922	Nuclear Reactor Science and Technology	9	12	None	Elective	None
NUC5942	Radiation Techniques and Applications	9	12	None	Elective	None
NUC5962	Special Topics in Nuclear Science and Technology	9	12	None	Elective	None
NUC5982	Computational Physics for Nuclear Scientists	9	12	None	Elective	None
Total credits			**144**			

YEAR 2

CODE	COURSE NAME	NQF LEVEL	CREDIT	PREREQUISITE	Compulsory/Elective	COREQUISITES
NUC5900	Thesis	9	120	**All Year 1 subjects passed**	Compulsory	None
Total credits			**120**			

Total credits for the programme = 144 (year 1) + 120 (year 2) = 264
NCB = Non-Credit Bearing

H.3.1.4. EXAMINATION REGULATIONS

Formal examinations, subject to external moderation, will take place at the end of each semester of the first year of the programme. A minimum continuous assessment mark of 40% and a minimum of 80% class attendance are required to be admitted to write the examination in a specific course. Students must pass all courses to proceed to the thesis component of the degree. In all cases, a minimum mark of 50% is required to pass.

H.3.1.5. FORMAT AND EVALUATION OF THESIS WORK

Before a candidate can proceed to the thesis, he/she must first successfully complete the coursework examinations. Each student will submit a Master Thesis/Dissertation at the end of this second year. The thesis must be in a format prescribed by the Department as per University regulations. The completed thesis will be evaluated by the supervisor(s) and one (or more, if needed) external examiners, normally within a month after submission. The student will be expected to successfully defend his/her thesis in a viva voce examination.

H.3.1.6. PRACTICALS

Attendance of practical classes, experiments, projects, field trips and/or internships as prescribed by the course lecturers and thesis supervisor(s) are compulsory.

H.3.2. COURSES: CODES, RESTRICTIONS, EQUIVALENTS AND CONTENTS

FIRST YEAR COURSES

NUC5911: PRINCIPLES OF NUCLEAR PHYSICS

Course title: **PRINCIPLES OF NUCLEAR PHYSICS**
Code: **NUC5911**
NQF level: 9
Contact hours: 4 hours per week for 1 semester and 36h of practical work or a mini project
Credits: 24
Course assessment: Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**)
Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites: MSc admission requirements
Course description: Review of atomic and nuclear structures**,** atomic and nuclear radiation, classification of radiation, natural and man-made sources of radiation; Radioactive decay and decay process; Radioactive Equilibrium; Interaction of heavy charged particle with matter: Maximum energy transfer, stopping power, range; Interaction of beta particles with matter: Collisional stopping power, radiative stopping power, radiation yield, range; Interaction of photon with matter; Neutron interaction with matter: elastic scattering and capture process; Nuclear binding energy; Nuclear reactions; Nuclear models; Fission and fusion.

NUC5901: NUCLEAR INSTRUMENTATION

Course title: **NUCLEAR INSTRUMENTATION**
Code: **NUC5901**
NQF level: 9
Contact hours: 2 hours per week for 1 semester and 18h of practical work or a mini project
Credits: 12
Course assessment: Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**)
Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites: MSc admission requirements
Course description: A review of the interaction of nuclear radiation with matter; Methods of radiation detection**:** Ionization in gases, gas-filled detectors, Scintillation detectors, semiconductor detectors and neutron detectors; Spectroscopy and spectra unfolding; Pulse signal processing; Statistics of counting and associated errors; Components of electronic detector systems: Rate meters, High voltage power supplies, AC-DC converters, Scalars, Amplifiers, Single channel analyze and Multi-channel analyzers.

NUC5921: MATHEMATICAL METHODS FOR NUCLEAR SCIENTISTS

Course title: **MATHEMATICAL METHODS FOR NUCLEAR SCIENTISTS**
Code: **NUC5921**
NQF level: 9
Contact hours: 2 hours per week for 1 semester and 18h of practical work or a mini project
Credits: 12
Course assessment: Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**)
Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites: MSc admission requirements
Course description: Complex variable techniques; Eigenvalue problems; Boundary value problems for ordinary differential equations, Integral equations and Partial differential equations. Analysis of data: Weighted mean, measure of dispersion, skewness and kurtosis; Significance tests and theory of errors; Binomial, Gaussian and Poisson distributions; Correlation ratio, smoothing and interpolation; Method of least squares in curve fitting and test of fit. Monte Carlo methods.

PHY5920: RESEARCH METHODOLOGY AND PROJECT PROPOSAL

Course title: **RESEARCH METHODOLOGY AND PROJECT PROPOSAL**
Code: **PHY5931**
NQF level: 9
Contact hours: 2 hours per week for 2 semesters
Credits: 24
Course assessment: Continuous Assessment (**100%**)
Continuous assessment will consist of reports son various topics and, most importantly, a well developed project proposal for his/her M.Sc. thesis.
Pre-requisites: None
Course description: Philosophical underpinnings of the Scientific Method, Fallacies of Reason & Rhetoric, aviding "bad science" and pseudoscience, ethical and legal issues, statistical and mathematical principles, error analysis and propagation, hypothesis verification/refutation, the IOP referencing style and citation; Logic and the taxonomy of the Fallacies of Rheason & Rhetoric, philosophical streams in the Philosophy of Science and overview of modern philosophers like Russell, Popper and Kuhn; Library resource utilization, mini literature reviuew projects in prospective fields of research, identification of supervisor(s), writing and presentation of a draft Research Proposal.

UAE5819: ACADEMIC WRITING FOR POSTGRADUATE STUDENTS

Course title: **ACADEMIC WRITING FOR POSTGRADUATE STUDENTS**
Code: **UAE5819**
NQF level: 8
Contact hours: 56 L
Credits: 24 (NCB)

Course assessment: Continuous Assessment 1 x 3-hour Exam Paper. Continuous Assessment may consist of a combination of tests, practicals and/or assignments.Subminima of 40% are required in both the continuous assessment and examination.
Pre-requisites: M.Sc. admission requirements
Course description (content): This course is a post-graduate course designed to empower students with skills and knowledge to access and critique academic sources and to synthesize information from these sources to assist them in the substantiation and development of their own claims when writing an academic paper in their respective fields of specialization. Additionally, this course will empower students with the capacity to undertake the challenges of academic writing by exposing them to the different rhetorical and stylistic elements typical of academic texts. Finally, students will be introduced to the American Psychological Association (APA) writing style and will be equipped with the necessary skills to format an academic paper in APA style.

NUC5912: **NUCLEAR CHEMISTRY**

Course title:	**NUCLEAR CHEMISTRY**
Code:	**NUC5912**
NQF level:	9
Contact hours:	4 hours per week for 1 semester and 36h of practical work or a mini project
Credits:	24
Course assessment:	Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**) Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites:	MSc admission requirements

Course description: Radionuclides in nature; Natural radioactivity and decay series; Anthropogenic radioactivity; Chemistry of nuclear materials; Radiolysis; radiochemical separation techniques, Radioisotope production; Isotope identification; Determination of activity concentration; Analytical techniques: α-spectrometry, β-spectrometry and γ-spectrometry; Neutron activation analysis: Instrumental neutron activation analysis and cyclic activation analysis.

NUC5932: **RADIATION PROTECTION AND HEALTH PHYSICS**

Course title:	**RADIATION PROTECTION AND HEALTH PHYSICS**
Code:	**NUC5932**
NQF level:	9
Contact hours:	4 hours per week for 1 semester and 36h of practical work or a mini project
Credits:	24
Course assessment:	Continuous Assessment (**50%**) and 1 x 3-hour Exam Paper (**50%**) Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites:	MSc admission requirements

Course description: Radiation sources; Effects of different types of radiation; Radiation quantities, units and measurements. Biological effects of radiation; Radiation safety guides and Philosophy of radiation protection. Health physics instrumentation: Radiation detectors, dose measuring instruments, neutron measurements, calibration of measuring instruments and counting statistics. External radiation protection: Distance, time and shielding, gamma-ray shielding, protection from beta radiation, and neutron shielding. Internal radiation protection.Computation of exposure and dose; Radiation shielding principles and radiation attenuation calculations.

NUC5902: **RADIOBIOLOGY**

Course title:	**RADIOBIOLOGY**
Code:	**NUC5902**
NQF level:	9
Contact hours:	2 hours per week for 1 semester and 18h of practical work or a mini project
Credits:	12
Course assessment:	Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**) Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites:	MSc admission requirements

Course description: Use of radioisotopes in molecular biology techniques; Radiation and mutations; Genomic instability; Molecular mechanisms of radiation damage; Total body irradiation; Inheritable effects of radiation; Effects of radiation on developing embryo; Radiation carcinogenesis; Radiation oncology technology, quality and safety. Brachytherapy; Radiation and cataracts; Radiation safety, radioprotectors and radiosensitizers; Mutation breeding; Radiation, food and nutrition; Radiation and water treatment.Biological impacts of nuclear accidents and disasters.

NUC5922: **NUCLEAR REACTOR SCIENCE AND TECHNOLOGY**

Course title:	**NUCLEAR REACTOR SCIENCE AND TECHNOLOGY**
Code:	**NUC5922**
NQF level:	9
Contact hours:	2 hours per week for 1 semester and 18h of practical work or a mini project
Credits:	12
Course assessment:	Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**) Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites:	MSc admission requirements

Course description: Review of nuclear energy. Uses and classification of reactors; Reactor components: Moderators, fuel, coolants and control rods. Determination of neutron fluxes using foil irradiation. Thermalization of neutrons; Macroscopic slowing down process. Steady state reactor core and four factor formula. Calculations of resonance escape probability and neutron leakage; Neutron balance equation; Flux distribution in rectangular slab reactor core and in cylindrical reactor core. Transient reactor behavior and control; Reactor safety, kinetics and control; Multi-group theory.

NUC5942: RADIATION TECHNIQUES AND APPLICATIONS

Course title:	**RADIATION TECHNIQUES AND APPLICATIONS**
Code:	**NUC5942**
NQF level:	9
Contact hours:	2 hours per week for 1 semester and 18h of practical work or a mini project
Credits:	12
Course assessment:	Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**) Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites:	MSc admission requirements

Course description: Radiation sources and irradiation facilities. Radioisotope applications in industry, agriculture, medicine and environment. Radioactive dating techniques. Theory of X-ray fluorescence and X-ray diffraction; Operation of X-ray fluorescence and X-ray diffraction machines. Neutron diffraction, Mossbauer spectroscopy and neutron activation analysis. Other applications and techniques in basic research.

NUC5962: SPECIAL TOPICS IN NUCLEAR SCIENCE AND TECHNOLOGY

Course title:	**SPECIAL TOPICS IN NUCLEAR SCIENCE AND TECHNOLOGY**
Code:	**NUC5962**
NQF level:	9
Contact hours:	2 hours per week for 1 semester and 18h of practical work or a mini project
Credits:	12
Course assessment:	Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**) Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites:	MSc admission requirements

Course description: Introduction to Nuclear law: Concept and principles of nuclear law, legislative process for nuclear law, and regulatory body and functions. Safe transportation of radioactive materials, and radioactive waste management. Accelerator physics: Historical development of accelerators, types of accelerators, applications in nuclear physics, material science, medicine, art and culture, environment and industry. Fusion reactors, neutron activation analysis and other topics of interest.

NUC5982: COMPUTATIONAL PHYSICS FOR NUCLEAR SCIENTISTS

Course title:	**COMPUTATIONAL PHYSICS FOR NUCLEAR SCIENTISTS**
Code:	**NUC5982**
NQF level:	9
Contact hours:	2 hours per week for 1 semester and 18h of practical work or a mini project
Credits:	12
Course assessment:	Continuous Assessment (**50%**) and 1 x 2-hour Exam Paper (**50%**) Continuous assessment will consist of at least two (2) class tests and/or assignments and practical report(s) and/or presentation(s) to be consolidated into one (1) practical mark.
Pre-requisites:	MSc admission requirements

Course description: Numerical integration and iterative methods; Monte Carlo method; Finite difference methods and finite element methods. Fourier and Laplace transformations; Special and orthogonal functions; Variation principle and optimization methods. Interpolation and approximation methods; Numerical solution of linear and non-linear systems. Eigenvalues and eigenvectors. Algorithms and software applications.

SECOND YEAR COURSE

NUC5900: THESIS

Course title:	**THESIS**
Code:	**NUC5900**
NQF level:	9
Contact hours:	N/A
Credits:	120
Course assessment:	Thesis to be submitted at the end of the year for internal and external examination.
Pre-requisites:	All courses of the first year must be completed.

Course description: The student will be required to undertake research activities in a selected topic of Nuclear Science and to submit a thesis. Students will work under the supervision of a researcher of their own choice which will enable the candidate to gain theoretical and analytical knowledge in course work to a substantive problem relevant to their area of specialization.

H.4.POST GRADUATE (MSC) CHEMISTRY PROGRAMME REGULATIONS

H.4.1. ADMISSION REQUIREMENTS

The MSc programme in the Department of Chemistry or Biochemsitry is open to all BSc graduates with Chemistry or Biochemistry as one of their majors respectively. The admission to the MSc programme of the holders of the B.Sc. Chemistry or Biochemistry degree is not automatic. The applicants will be accepted on the basis of their undergraduate record. An average mark of **60%** is required. The course normally extends over a minimum period of two years for full-time students.

MSc apllicants for Photovoltaics or Renewable Energy Materials may be required to complete selected undergraduate NQF level 8 courses from **either** the Department of Chemistry and Biochemistry **or** the Department of Physics and obtain a 60% average in those modules before applying for admission to this qualification:

- Applicants planning to specialise in **Renewable Energy Materials** must register and complete (for non-degree purposes) *Inorganic Chemistry III* (CHM3802), *Organic Chemistry III* (CHM3811), *Physical Chemistry III* (CHM3831) and *Instrumental Analysis II* (CHM3801).
- Applicants planning to specialise in **Photovoltaics** must register and complete (for non-degree purposes) *Quantum Mechanics* (PHY3811), *Statistical Mechanics* (PHY3831), and *Solid State Physics* (PHY3812).

H.4.2. DURATION OF STUDY

The duration of the MSc in Chemistry is two (2) years for full-time students and three (3) years for part-time students. Relevant committees may grant an extension of registration up to six (6) months beyond the stipulated period if valid reasons are advanced.

H.4.3. CURRICULUM COMPILATION

The curriculum for the MSc Chemistry consists of coursework and the writing of a research thesis. Refer to the Regulations for Postgraduate Courses of study in the General Prospectus: Information, Regulations & Fees.

H.4.4. ASSESSMENT CRITERIA

The curriculum for the MSc programme in the Department of Chemistry consists of coursework and research leading to a thesis. Coursework component in the first year will be assessed through written tests, laboratory work, seminar presentation and final examination. Each course assessment is based on continuous assessment mark (50%) and examination mark (50%). Continuous assessment mark is computed as 60% test and 40% practical mark. In order to pass a course, a student must obtain a final mark of at least 50%. Refer to specific courses for detailed assessment criteria.

MSC THESIS IN THE SECOND YEAR:
A candidate must first successfully complete the coursework examinations before commencing thesis work. The thesis must be drafted in English language and submitted to the supervisor. It must be in a university approved format. The thesis will be evaluated by UNAM approved internal and external examiners. The UNAM grading system will be used for the evaluation. Each student will defend the thesis in a viva voce examination. Refer to the General Information and Regulations Prospectus and Postgraduate Prospectus for detailed information.

H.4.5. REQUIREMENTS FOR QUALIFICATION AWARD

This qualification will be awarded to candidates credited with a minimum of 264 credits, and who have met all the requirements of the degree programme.

MSc in Photovoltaics or Renewable Energy Materials: This qualification will be awarded to candidates credited with 240 NQF level 9 credits as prescribed in the curriculum, and who have met all the requirements of the programme with respect to the thesis component.

H.4.6. EXEMPTIONS

UNAM will give exemptions for equivalent courses taken at other tertiary institutions but the exemptions shall not exceed 50% of the programme in line with the General Information and Regulations Prospectus.

H.4.7. CLASS ATTENDANCE

In order to be admitted to examinations, students are required to attend at least 80% of the lectures and to complete the required elements that make up the continuous assessment mark. Hundred percent attendances of practical classes are required.

H.5. MASTER OF SCIENCE IN CHEMISTRY (11MSCC)

TABLE FOR ALL COURSES IN THE PROGRAMME

Course code	Course name		Credits	Compulsory (C) /Elective (E)	Prerequisites
Year 1 Semester 1					
UAE5819	Advanced Academic Writing for Post Graduate Students		24	C	None
CHM5961	Chemistry Seminars		12	C	None
CHM5911	Advanced Analytical and Instrumental Methods		24	C	None
CHM5991	Research Methodology and Project Proposal		12	C	None
Electives (Any two courses)					
CHM5931	Advanced Organic Chemistry		24	E	None
CHM5951	Advanced Inorganic Chemistry		24	E	None
CHM5971	Advanced Physical Chemistry		24	E	None
CHI5931	Advanced Industrial Chemistry		24	E	None
Year 1 Semester 2: Electives (Any two courses)					
CHM5912	Current Topics in Analytical Chemistry		24	E	CHM5911
CHM5932	Current Topics in Organic Chemistry		24	E	CHM5931
CHM5972	Current Topics in Physical Chemistry		24	E	CHM5971
CHM5952	Current Topics in Inorganic Chemistry		24	E	CHM5951
CHI5932	Current Topics in Industrial Chemistry		24	E	CHI5931
Total credits Year 1					**144**
YEAR 2					
CHM5900	M.Sc. Thesis		120	C	Pass in all year 1 courses
Total credits Year 2					**120**
Total credits for the programme					**264**

H.6. MASTER OF SCIENCE IN RENEWABLE ENERGY: MATERIAL SCIENCE STREAM (11MSRM)

TABLE FOR ALL COURSES IN THE PROGRAMME

SEMESTER	COURE NAME	CODE	CREDITS	COMPULSORY (C) / ELECTIVE (E)	PREREQUISITES
1	Advanced Academic Writing for Post Graduate Students	UAE5819	(24*)	C	None
1 & 2	Research Methodology and Project Proposal	REP5920	24	C	None
1	Advanced Theory of Solar Cells I	REP5911	24	C	None
1	Renewable Energy Frontiers	REP5931	24	C	None
2	Advanced Theory of Solar Cells II	REP5912	24	C	REP5911
2	Computational Methods in Material Science	REM5932	24	E	None
2	Electroceramics, Electronic, Optical, Magnetic and Characterization of Materials	REM5952	24	E	None
Total credits Year 1					**120**
YEAR 2					
1 & 2	M.Sc. Thesis	MRE5900	120	C	Pass in all year 1 courses
Total credits Year 2					**120**
Total credits for the programme					**240**

*(Credits for this UNAM compulsory course do not contribute to the total credits for this qualification)

H.7. MASTER OF SCIENCE IN RENEWABLE ENERGY: PHOTOVOLTAICS STREAM (11MSRP)

TABLE FOR ALL COURSES IN THE PROGRAMME

SEMESTER	COURE NAME	CODE	CREDITS	COMPULSORY (C) / ELECTIVE (E)	PREREQUISITES
1	Advanced Academic Writing for Post Graduate Students	UAE5819	(24*)	C	None
1 & 2	Research Methodology and Project Proposal	REP5920	24	C	None
1	Advanced Theory of Solar Cells I	REP5911	24	C	None
1	Renewable Energy Frontiers	REP5931	24	C	None
2	Advanced Theory of Solar Cells II	REP5912	24	C	REP5911
2	Characterization of Photovoltaic Devices	REP5932	24	E	None
2	Photovoltaic Systems	REP5952	24	E	None
Total credits Year 1					**120**
YEAR 2					
1 & 2	M.Sc. Thesis	MRE5900	120	C	Pass in all year 1 courses
Total credits Year 2					**120**
Total credits for the programme					**240**

*(Credits for this UNAM compulsory course do not contribute to the total credits for this qualification)

FIRST YEAR

SEMESTER 1

CHM5911 Advanced Analytical and Instrumental Methods	
Course Title:	**Advanced Analytical and Instrumental Methods**
Code:	**CHM5911**
NQF Level:	9
Contact Hours:	4 lectures per week for one semester and 36h Practical or mini project
Credits:	**24**
Course Assessment:	**CA** two tests which counts 80%; Laboratory work (or mini project) 20% towards. **Examination:** There is a one 3hr examination **Final Mark: 50%** CA mark and **50%** Examination mark
Prerequisites:	None

Course Description: (Selected topics of the following will be covered)**:** Electro-analytical chemistry: Ion selective electrodes, potentiometry, polarography, coulometry and electro-gravimetry. Advanced techniques in electro-analytical chemistry; solution electrode interface, Buttler-Volmer relationships, Chromatography - Theory of chromatography, High Performance Liquid Chromatography (HPLC), ion chromatography, supercritical fluid chromatography. Mass Spectrometry: (GC-MS) and Liquid Chromatography – Mass Spectrometry (LC-MS). Advanced mass spectrometry, basic instrumentation, ionization techniques, analyzers and detectors, vacuum technology, detailed ion fragmentation patterns and the practical application of electron impact, chemical ionization and other auxiliary mass spectrometry techniques, e.g. FABMS and electro spray MS, to the structure elucidation of both small and large organic molecules. X-ray analysis methods: Theory of X-ray Spectra. Conventional X-ray fluorescence analysis.Methods and instrumentation for excitation, dispersion detection and interpretation.Matrix effects and their avoidance.Energy dispersive X-ray analysis.Alternative X-ray analysers.Electron microprobe analyser.Single crystal X-ray analysis.Crystallography (theoretical principles, theory of crystals, X-rays, crystallographic techniques, structure determinations. NMR-Practical application of 1D and 2D Fourier transform NMR techniques. ^{1}H NMR and ^{13}C NMR.Non-first order spectra, basic experiments in DEPT, J-Mod. NOE diff. 2D homo-nuclear NMR- COSY, NOESY, TOCSY; hetero-nuclear direct (1J)- HECTOR, HMQC,HSQC; hetero-nuclear long range HMBC, LR HECTOR and COLOC.; selective 1D experiments: SEL TOCSY and SEL NOESY. Application of Analytical techniques to food science, pesticide analysis, forensic analysis, bio-analytical chemistry as well as other topics that are of interest.

CHB5921 ENZYMOLOGY AND ENZYME TECHNOLOGY	
Course Title:	**Enzymology and Enzyme Technology**
Course Code	**CHB5921**
NQF Level	9
Contact Hours	2 lecturesper week for one semester and 18h (cumulative) practical
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 60%, Laboratory Mark (or mini project) counts 40%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Prerequisite	None

Course Descriptor:Amino Acids and Peptides; Introduction to amino acids, peptides and proteins; Structures and properties of peptides; enzymes; Analysis of peptides and proteins; End group analysis of peptides; Solution phase peptide synthesis; Enzymes and Enzyme Inhibitors; Inhibition of hydrolases and peptidases, ACE inhibitors, Enzyme Technology - Large scale production of enzymes, enzyme reactors, immobilization of enzymes by chemical and physical methods, Effect of partition on kinetics and on changes in pH and hydrophobicity. Applications: synthetic organic chemistry, industry, food technology, medicines. Synzymes, enzyme electrodes and biosensors, Enzyme Engineering.

CHM5921RESEARCH METHODOLOGY AND PROJECT PROPOSAL	
Course Title:	**Research Methodology and Project Proposal**
Course Code	**CHM5921**
NQF Level	9
Contact Hours	2 lectures per week and 2h consultation per week for one semester
NQF Credits	12
Continuon Assessment	Research proposal counts 80% and Statistics assessed by a test, assignment or report count 20%. **Final Mark: 100%** CA from which 20% is statistics component.
Prerequisite	None

Course Descriptor: The lecturers will present some chemostatistics topics i.e. handling experimental data, processing and reporting, e.g. significance tests. Analysis of variance (ANOVA), regression analysis methods, validation experimental data (quality control) and experimental design and optimization of parameters. The student will write a comprehensive research proposal for his/her MSc research work in a particular field of national interest, under the supervision of an academic researcher. The evaluation will be done in accordance with UNAM Post-graduate School guidelines.

CHI5931 Advanced Industrial Chemistry

Course Title:	**Advanced Industrial Chemistry**
Code:	**CHI5931**
NQF Level:	9
Contact Hours:	4 lectures per week for one semester and 36h Practical or mini project
Credits:	**24**
Course Assessment:	**CA** two tests which counts 80%; Laboratory work (or mini project) 20% towards. **Examination:** There is a one 3hr examination **Final Mark: 50%** CA mark and **50%** Examination mark
Prerequisites:	None

Course Description: Selected topics of the following will be covered: Momentum transfer, Mass transfer, Heat transfer, mixing process of liquids, chemical reaction kinetics, reactor design, Homogeneous chemical reaction, Heterogeneous chemical reaction and Industrial process equipment.

CHB5961 NEUROBIOCHEMISTRY AND CLINICAL BIOCHEMISTRY

Course Title:	**Neurobiochemistry and Clinical Biochemistry**
Course Code	**CHB5961**
NQF Level	9
Contact Hours	2 lectures per week for one semester and 18h (cumulative) practical
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 60%, Laboratory Mark (or mini project) counts 40%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Prerequisite	None

Course Descriptor: Muscle Biochemistry – Skeletal muscle structure. Actin, myosin, tropomyosin, troponin.Molecularmechanism of contraction. Functional classification of skeletal muscle fibers. Twitch. The motor unit.Role of calmodulin. Neuromorphology – Organisation of neuron, dendrites and axons. Glial cells – astrocytes, oligodendrocytes, ependymal cells, Schwan cells. Nerve fiber types and functions. Neurophysiology – Generation and conduction of monophasic action potential, saltatory conduction. Synaptic transmission, Neurotransmitters and their action.Blood Brain CSF barrier – Characteristics. Transport across membranes – Types of transport (simple diffusion, passive-facilitated diffusion), active transport – primary and secondary group translocation, transport ATPases, transport by vesicle formation. **Neurological dis**or**ders** – Headache, facial pain, migraine, epilepsy, multiple sclerosis, Myasthenia Gravis. Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption of electrolytes. **Diagnostic Enzymes** – Enzymes in health and diseases. Biochemical diagnosis of diseases by enzyme assays – SGOT, SGPT, CPK, cholinesterase, LDH. **Abn**or**malities in Nitrogen Metabolism** – Uremia, hyperuricemia, porphyria and factors affecting nitrogen balance. Blood Clotting – Disturbances in blood clotting mechanism – hemorrhagic disorders – hemophilia, von Willebrand's disease, purpura, Rendu-Osler-Werber disease, thrombotic thrombocytopenic purpura, disseminated intravascular coagulation, acquired prothrombin complex disorders, circulating anticoagulants. Cancer – Cellular differentiation, carcinogens and cancer therapy

CHM5951 Advanced Inorganic Chemistry

Course Title:	**Advanced Inorganic Chemistry**
Code:	**CHM5951**
NQF Level:	9
Contact Hours:	4 lectures per week for one semester and 36h Practical or mini project
Credits:	**24**
Course Assessment:	**CA** two tests which counts 80%; Laboratory work (or mini project) 20% towards.
Examination:	There is a one 3hr examination **Final Mark: 50%** CA mark and **50%** Examination mark
Prerequisites:	None

Course Description: Selected topics of the following will be covered: The chemistry of 17(halogens) and 18(noble gases). Lanthanides and Actinides Solid State Chemistry: Lattice energy; bonding in solids – bond model. Electrical properties of semiconductors; doped semiconductors.Defects and non-stoichiometry. Low-dimensional solids: one-dimensional solids; two-dimensional solids. Optical properties of solids; optical fibres. Magnetic properties of solids; Superconductors: theory, magnetic properties, Josephson effects. Isolobal analogies and relationships.Metal-metal bonds. Cluster compounds. Bioinorganic Chemistry.

CHM5931 Advanced Organic Chemistry

Course Title:	**Advanced Organic Chemistry**
Code:	**CHM5931**
NQF Level:	9
Contact Hours:	4 lectures per week for one semester and 36h Practical or mini project
Credits:	**24**
Course Assessment:	**CA** two tests which counts 80%; Laboratory work (or mini project) 20% towards.
Examination:	There is a one 3hr examination **Final Mark: 50%** CA mark and **50%** Examination mark
Prerequisites:	None

Course Description: *Stereochemistry:* definition of terms, representations, conformational analysis; *Stereoselective synthesis:* strategies in stereoselective synthesis (substrate control, chiral auxiliary control, reagent control and catalyst control); *Pericyclic reactions:* the frontier orbital theory, orbital symmetry study and application to electrocyclic reactions, sigmatropic hydride shifts and cycloaddition reactions; *Retrosynthetic analysis:* definitions, functional group interconversion, synthons, umpolung, protective groups, one-group disconnections, two-group disconnections; *Organometallic compounds in synthesis:* organo-sulphur chemistry, organolithium compounds, direct ortho-metallation, synthetic applications; *Polymer chemistry:* the polymerization process, condensation polymers, addition polymers, block, graft and ladder polymers, selected applications, recycling: *Natural product chemistry*: classification of natural products, approaches to the study of natural products, selected natural products, biosynthesis, total synthesis.

CHM5971Advanced Physical Chemistry

Course Title:	**Advanced Physical Chemistry**
Code:	**CHM5971**
NQF Level:	9
Contact Hours:	4 lectures per week for one semester and 36h Practical or mini project
Credits:	**24**
Course Assessment:	**CA** two tests which counts 80%; Laboratory work (or mini project) 20% towards.
Examination:	There is a one 3hr examination **Final Mark: 50%** CA mark and **50%** Examination mark
Prerequisites:	None

Course Description: Selected topics of the following will be covered: Advanced kinetics: rates of chemical reactions; reactions in the gas and solution phases; complex reactions. Quantum Chemistry. Computational Chemistry: practical applications of electronic structure methods [Density Functional Theory (DFT) and Ab-initio Methods]; Molecular dynamics. Biophysical Chemistry.Statistical Mechanics.

CHM5961 Chemistry Seminars

Course Title:	**Chemistry Seminars**
Code:	**CHM5961**
NQF Level:	9
Contact Hours:	2 lectures/consultations per week for one semester
Credits:	**12**
Course Assessment:	Presentations are graded by staff members and count toward the CA mark. **Final Mark: 100%**CA mark
Prerequisites:	None

Course Description: The main component of this course involves the application of presentation skills through seminars, review of scientific literature and communication of recent developments in chemistry and biochemistry.

CHM5991 Research Methodology and Project Proposal

Course Title:	**Research Methodology and Project Proposal**
Code:	**CHM5991**
NQF Level:	9
Contact Hours:	2 lectures per week and 2h consultation per week for one semester
Credits:	**12**
Course Assessment:	Research proposal is graded and counts 80% toward the CA mark. Statistics component t is assessed by a test, assignment or report and count 20% towards the CA mark. Final Mark: **100%** CA from which 20% is statistics component.
Prerequisites:	None

Course Description: The lecturers will present some chemostatistics topics i.e. handling experimental data, processing and reporting, e.g. significance tests. Analysis of variance (ANOVA), regression analysis methods, validation experimental data (quality control) and experimental design and optimization of parameters. The student will write a comprehensive research proposal for his/her MSc research work in a particular field of national interest, under the supervision of an academic researcher. The evaluation will be done at departmental level.

REP5920 RESEARCH METHODOLOGY AND PROJECT PROPOSAL

Course Title:	**Research Methodology and Project Proposal**
Course Code	**REP 5920**
NQF Level	9
Contact Hours	2 lectures per week and 2h consultation per week for one semester
NQF Credits	24
Continuous Assessment	Research proposal counts 40%, 3 assignments counts 30%, two mini-literature review reports count 20%, and 2 presentations minimum counts 10%. **Final Mark: 100%** CA.
Prerequisite	Programme entry requirements

Course Descriptor: The Philosophical underpinnings the Scientific Method, The Fallacies of Reason and Rhetoric, avoiding “bad science” and pseudoscience, ethical and legal issues, statistical and mathematical principles, error analysis and propagation, hypothesis verification/refutation, the IOP (Institute of Physics) referencing style and citation; Logic and the taxonomy of Fallacies of Reason & Rhetoric, philosophical streams in the Philosophy of Science (empiricism, positivism, logical positivism, analytic philosophy) and overview of modern philosophers of science like Bertrand Russell, Carl Popper and Thomas Kuhn; Library resource utilisation, e.g. finding specific papers on systems like JSTOR, mini literature review projects in prospective fields of research, identification of thesis supervisor(s) and project, extensive literature review under guidance of chosen supervisor(s), writing and presentation of a Research Proposal as per UNAM regulations.

UAE 5911 ADNVACED THEORY OF SOLAR CELLS I	
Course Title:	**Advanced Theory of Solar Cells I**
Course Code	**UAE 5911**
NQF Level	9
Contact Hours	2 lectures per week for one semester and and 18h (cumulative) practical
NQF Credits	24
Continuous Assessment	A minimum of two tests which counts 40%, Laboratory Mark (or Mini project) counts 50%, at least 2 presentations which counts 10%, Examination: 1x3hr examination. Final Mark: 50% CA mark and 50% Examination mark
Prerequisite	None

Course Descriptor: Review of Modern Physics: topics in quantum mechanics, electromagnetic theory, statistical thermodynamics; Fundamentals of semiconductors: crystals and crystal structure, energy bands, direct and indirect band gap; density of states, carrier distribution functions, carrier densities and carrier transport, intrinsic and extrinsic semiconductors (doping) , carrier generation and recombination, continuity equation, drift-diffusion model, Fermi levels, quasi-Fermi energy levels; p-n junction electrostatics; diode equation, depletion approximation, fundamentals of solar cells: solar cell boundary conditions; p-n junction under illumination: absorption of light, carrier generation and recombination, charge collection probability.

REP 5931 RENEWABLE ENERGY FRONTIERS	
Course Title:	**Renewable Energy Frontiers**
Course Code	**REP 5931**
NQF Level	9
Contact Hours	2 lectures per week for one semester and and 18h (cumulative) practical
NQF Credits	24
Continuous Assessment	A minimum of two tests which counts 40%, Laboratory Mark (or Mini project) counts 50%, at least 2 presentations which counts 10%, Examination: 1x3hr examination. Final Mark: 50% CA mark and 50% Examination mark
Prerequisite	None

Course Descriptor: Overview of renewable energy technologies; system-view of the manufacturing process that aims to efficiently use energy, water and other raw materials, to minimize air and water pollution and generation of waste per unit of the manufactured product; the course will discuss methods to maximize yield and minimize waste effluents in processes, ways to devise treatment strategies for handling manufacturing wastes. Innovative ways to decrease energy consumption manufacturing; by-product use and product recycling; policies that encourage green manufacturing; quality and environmental standards.

SEMESTER 2

CHM5912 Current Topics in Analytical Chemistry	
Course Title:	**Current Topics in Analytical Chemistry**
Code:	**CHM5912**
NQF Level:	9
Contact Hours:	4 lectures per week for one semester
Credits:	**24**
Course Assessment:	A minimum of two independent study reports (or one report and one test) which counts 80% towards the continuous assessment mark (CA). **Presentations:** at least one presentation which counts 20% towards the CA mark. **Examination:** There is one 3hr examination at the end of the semester andcounts 50% towards the final mark. **Final Mark: 50%** Continuous Assessment (literature review 2500 words) and **50%** Examination
Prerequisites:	Advance Analytical and Instrumental Method (SCHM5911)

Course Description: Students will be asked to perform literature review, write reports, present and conduct seminars in the current advances in the following topics (topics may change): Topic 1- inductive coupled plasma M.S. and atomic absorption spectroscopy, Topic 2- application of analytical techniques in environmental monitoring., Topic 3- ion-exchange, size-exclusion and reversed phase HPLC., Topic 4- supercritical–fluid chromatography, affinity and chiral chromatography and capillary-electro chromatography. Topic 5- voltametric, potentiometric and polarographic methods.Topic 6- atomic mass spectrometry {spark source M.S, glow discharge M.S} and atomic fluorescence spectroscopy.

CHM5932 Current Topics in Organic Chemistry	
Course Title:	**Current Topics in Organic Chemistry**
Code:	**CHM5932**
NQF Level:	9
Contact Hours:	4 lectures per week for one semester
Credits:	**24**
Course Assessment:	A minimum of two independent study reports (or one report and one test) which counts 80% towards the continuous assessment mark (CA). **Presentations:** at least one presentation which counts 20% towards the CA mark. **Examination:** There is one 3hr examination at the end of the semester and counts 50% towards the final mark. **Final Mark: 50%** Continuous Assessment (literature review 2500 words) and **50%** Examination
Prerequisites:	Advance Organic Chemistry (SCHM 5931)

Course Description: Students will be asked to perform literature review, write reports, present and conduct seminars in the current advances in the following topics (topics may change): Amide coupling reagents: applications & limitations Recent advances in C-C bond formation reactions; Natural Products in Drug Discovery; Advances in Biomimetic Organic Synthesis Advances in the Huisgen 1,3-dipolar cycloaddition reaction and its application in drug discovery; Advances in multicomponent reactions (mcr) and their application in drug discovery; Complex natural product synthesis; Chiral auxiliaries: principles, preparations and recent applications;

Advances in chemoenzymatic synthesis; Advances in the synthesis of heterocycles; Introduction of Quaternary stereogenic centers; Biosynthetically inspired approaches to natural product synthesis; Stereoselective Aldol reactions; Advances in Physical Organic Chemistry; Advances in Functional group transformations; Advances in the synthesis of Alkene, Alkynes, Allenes, etc Functional group protection.

CHM5972 Current Topics in Physical Chemistry

Course Title:	**Current Topics in Physical Chemistry**
Code:	**CHM5972**
NQF Level:	9
Contact Hours:	4 lectures per week for one semester
Credits:	**24**
Course Assessment:	A minimum of two independent study reports (or one report and one test) which counts 80%towards the continuous assessment mark (CA). **Presentations:** at least one presentation which counts 20% towards the CA mark. **Examination:** There is one 3hr examination at the end of the semester andcounts 50% towards the final mark. **Final Mark: 50%** Continuous Assessment (literature review 2500 words) and **50%** Examination
Prerequisites:	Advanced Physical Chemistry (SCHM5971

Course Description: Students will be asked to perform literature review, write reports, present and conduct seminars in the current advances in the following topics (topics may change): Topic 1; quantum and computational chemistry, topic 2 molecular spectroscopy, topic 3 chemical kinetics and dynamics, topic 4 statistical thermodynamics; topic 5 interstellar chemistry.

CHM5952 Current Topics in Inorganic Chemistry

Course Title:	**Current Topics in Inorganic Chemistry**
Code:	**CHM5952**
NQF Level:	9
Contact Hours:	4 lectures per week for one semester
Credits:	**24**
Course Assessment:	A minimum of two independent study reports (or one report and one test) which counts 80% towardsthe continuous assessment mark (CA). **Presentations:** at least one presentation which counts 20%towards the CA mark. **Examination:** There is one 3hr examination at the end of the semester andcounts 50% towards the final mark. **Final Mark: 50%** Continuous Assessment (literature review2500 words) and **50%** Examination
Prerequisites:	Advanced Inorganic Chemistry (SCHM5951

Course Description: Students will be asked to perform literature review, write reports, present and conduct seminars in the current advances in the following topics (topics may change): Reactions of coordinated diatomic ligands NO, CO and NO_2, Boron hydrides compounds, fullerenes chemistry of transition metals, transition metal complexes containing s-based ligands

CHI5932 Current Topics in Industrial Chemistry

Course Title:	**Current Topics in Industrial Chemistry**
Code:	**CHI5952**
NQF Level:	9
Contact Hours:	4 lectures per week for one semester
Credits:	**24**
Course Assessment:	A minimum of two independent study reports (or one report and one test) which counts 80%towards the continuous assessment mark (CA). **Presentations:** at least one presentation which counts 20% towards the CA mark. **Examination:** There is one 3hr examination at the end of the semester and counts 50% towards the final mark. **Final Mark: 50%** Continuous Assessment (literature review 2500 words) and **50%** Examination
Prerequisites:	Advanced Industrial Chemistry (CHI5931)

Course Description: Students will be asked to perform literature review, write reports, present and conduct seminars in the current advances in the following topics (topics may change); technical processes invented in industrial chemistry; nanomaterials created in industrial chemistry; chemical reaction, equipment designed and used; newly invented substances and technical method.

CHM5962 INSTRUMENTAL METHODS AND TECHNIQUES IN BIOCHEMICAL ANALYSIS

Course Title:	**Instrumental Methods and Techniques in Biochemical analysis**
Course Code	**CHM5962**
NQF Level	9
Contact Hours	2 lectures per week for one semester and 18h (cumulative) practical
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 50%, Laboratory Mark (Mini project) counts 50%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Co-requisite	CHM5911

Course Descriptor:Extraction of Organic Analytes: Sampling; Proximate Analysis of the Major Food Components; **Partition:** Gas/Liquid Partition (GLP), Liquid/Liquid Partition (LLP); Solid/Liquid Partition (SLP); **Solvation:**Solvent Extraction; Matrix Solid-phase Dispersion; Sub-critical Fluid Extractions; Supercritical Fluid Extraction; Distillation Steam Distillation; Organic Solvent Distillation–Extraction; Adsorption. **Solid-phase Extraction:** application of HPLC, GC, FTIR, AA, AFS, MS and NMR to food analysis. **TRACE METAL DETERMINATIONS IN BIOLOGICAL SAMPLES:** Bioavailability; Methods for Assessing Folate and Vitamins Bioavailability; Physicochemical Analytical Techniques for Vitamins. **Recombinant DNA methods** –Construction and analysis of c-DNA and genomic libraries - Protocols and strategies for c-DNA cloning, preparation of radio-labeled DNA and RNA probes, synthetic oligonucleotide probes, expression of cloned genes in cultured cells, screening expression with antibodies and oligonucleotides, DNA sequencing. **Application of recombinant technology:** production of insulin, drugs, vaccines, diagnostic probe of genetic diseases, Ggne therapy. **Cell Culture and Antibody Technology:** production, maintenance and applications of animal cell cultures and antibodies (both monoclonal and polyclonal), and the use of immunochemical techniques (e.g. ELISA, Western blotting and immunocytochemistry) for analysis and therapy, investigate the use of cellular systems for the study of mechanisms of toxicity and cell signalling pathways. Electrophoretic techniques, Electron microscopy .

CHB5962 STRATEGIC RESOURCE MANAGEMENT

Course Title:	**Strategic Resource Management**
Course Code	**CHB5962**
NQF Level	9
Contact Hours	2 lectures per week for one semester
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 80%, Laboratory Mark (or mini project) counts 20%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Co-requisite	CHM5921

Course Descriptor: Plant breeders' rights, the impact of genetically modified organisms and environmental monitoring, Biological safety conventions, environmental risk assessments and managment; Definitions and classifications of projects. Objectives in project management - time, costs, quality; Resources and resource management; Critical Path Methods and resource scheduling; Performance measurement and costs; Project lifecycles; Project teams and leadership in project management; Managing risk in projects; Analysis of project successes and failures; Case studies in project management; Project Management software. Examine innovation from an industrial perspective, showing how innovations of product, process and organisational structure can create and destroy markets. Focus on innovation from an organisational perspective, showing how innovation can create and sustain a powerful competitive advantage. Highlight the managerial perspective, illustrating the skills and systems required to maintain innovation within different organisations and markets. Consumer's attitudes and risk assessment: Risk assessment and avoidance: general principles; Assessing the impact of genetically modified crops;

CHB5902 BIOINFORMATICS AND INDUSTRIAL BIOTECHNOLOGY

Course Title:	**Bioinformatics and Industrial Biotechnology**
Course Code	**CHB5902**
NQF Level	9
Contact Hours	2 lecturesper week for one semester and 18h (cumulative) practical
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 60%, Laboratory Mark (or mini project) counts 40%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Co-requisite	CHB5921

Course Descriptor: Genomics,Transcriptomics, Proteomics: Introduction to Programming using Java; Theory and Algorithms in Bioinformatics; Genomes to Systems; Biocomputing; structure-based drug design. Conventional and non-conventional techniques of plant hybridisation, Agrobacterium-induced transformation using wild-type and engineered strains of A. tumefaciens and A. rhizogenes; **Tissue culture,** micropropagation and protoplast fusion; DNA isolation for RAPD analysis and confirmation of hybridity; Evaluation of RAPD fragments patterns for **phylogeny analysis**; Analysis of transgenic plants and GMO testing. Direct DNA uptake into protoplasts; flow cytometric analysis for ploidy. **plant products for non-food uses**, toxicology of natural pharmacologically active constituents and the use of transgenic plant technology for medical purposes. **molecular approaches to varietal profiling**, seed quality testing, transformation technology for modifying plant metabolism and modern breeding perspectives and strategies in a commercial context. comparisons of mutant with wild-type of model plant and crop species Arabidopsis and Maize lines, bioinformatics analysis of the genes involved in these phenotypes is undertaken. **Fermentation technology** – Fermentors, general design of fermentor, fermentation processes, production of alcohols, antibiotics, steroids and enzymes; biotransformation, biomass & production of single cell protein.**Hybridoma technology** – Monoclonal antibodies, selection of hybrids, hybridomas, purification and application of monoclonal antibodies.**Major Products of Industrial Microbiology:** Antibiotics, Penicillin, Streptomycin, Amino Acids, Organic Acids, Biopolymers, Biosurfactants; Bioconversion Processes.

CHB5942 BIOCHEMISTRY SEMINARS

Course Title:	**Biochemistry Seminars**
Course Code	**CHB5942**
NQF Level	9
Contact Hours	2 lectures per week for one semester
NQF Credits	12
Continuon Assessment	Presentations are graded by all the programme lecturers and count toward the CA mark. **Final Mark: 100%** CA mark
Co-requisite	CHM5921

Course Descriptor: The main component of this course involves the application of presentation skills through seminars, review of scientific literature and communication of recent developments in biochemistry.

CHN5942 NATURAL PRODUCTS AND PHARMACEUTICAL PRODUCTION

Course Title:	**Natural products and Pharmaceutical Production**
Course Code	**CHN5942**
NQF Level	9
Contact Hours	2 lectures per week for one semester and 18h (cumulative) practical
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 60%, Laboratory Mark (or Mini project) counts 40%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Co-requisite	CHB5961

Course Descriptor: GenePharming (Animals and Plants) Vitamins, Amino Acids, Proteins Antibiotics, Biocatalysis. **Natural Compounds** Recovery/(Bio-Processing, Chemical–Biotechnological Syntheses, Gene Therapy. **Vectors/Systems Production:** Safety, Efficacy, Consistency, and Specificity Registration. Terpenes, occurrence, nomenclature and classification; Biosynthesis and structure of the steroids; Fatty acids and cell wall structures; The prostaglandins; The alkaloids. Cell wall structure and peptidoglycan targets b-Lactam antibiotics: action and b-lactamase chemistry, Sulfonamides, **Metabolic targets:** pyridoxal dependent groups, Gastric acid secretion as a target for chemotherapy, Chemical regulation of acid secretion.

CHC5942 ENVIRONMENTAL TOXICOLOGY AND MANAGEMENT

Course Title:	**Environmental Toxicology and Management**
Course Code	**CHC5942**
NQF Level	9
Contact Hours	2 lectures per week for one semester and 18h (cumulative) practical
NQF Credits	12
Continuon Assessment	A minimum of two tests which counts 60%, Laboratory Mark (or mini project) counts 40%, **Examination**: 1x2hr examination. **Final Mark: 50%** CA mark and **50%** Examination mark
Co-requisite	CHB5941

Course Descriptor: Microbial Growth in Complex Environments: Biodegradation Using Natural Microbial Communities; Changing Environmental Conditions to Stimulate Biodegradation; **Subsurface Engineered Bioremediation** System; Stimulating Hydrocarbon Degradation in Waters and Soils; Phytoremediation; Stimulation of Metal Bioleaching from Minerals; **Biosensors:** Detection of pollution, and microbial contamination of water. Fermentation analysis and control Monitoring of industrial gases and liquids Measurement of toxic gas in mining industries Direct biological measurement of flavors, essences, and pheromones; **Biopesticides; Xenobiotic metabolism** – Biodegradation, detoxification of xenobiotics by micro-organisms, biodegradation of hydrocarbons, pesticides, surfactants, polyaromatic hydrocarbons, dyes; role of cytochrome P450 in detoxification.

UAE 5912 ADNVACED THEORY OF SOLAR CELLS II

Course Title:	**Advanced Theory of Solar Cells II**
Course Code	**UAE 5912**
NQF Level	9
Contact Hours	2 lectures per week for one semester and and 18h (cumulative) practical
NQF Credits	24
Continuous Assessment	A minimum of two tests which counts 50%, Laboratory Mark (or Mini project) counts 40%, atleast 2 presentations which counts 10%, Examination: 1x3hr examination. Final Mark: 50% CA mark and 50% Examination mark
Prerequisite	**REP5911**

Course Descriptor: Photovoltaic effect, characteristic curves, solar cell parameters; limitations to energy conversion in solar cells, quantum efficiency and spectral response, ideal and non-ideal solar cells; effects of light intensity and temperature; solar cell equivalent circuit models; metal-semiconductor junction; Solar cell technologies and fabrication: silicon solar cells, thin film solar cells, multi-junction solar cells; Emerging solar cell technologies dye sensitized solar cells and their syntheses; organic solar cells, quantum dot cells, inorganic solar cells.

REM 5932 COMPUTATIONAL METHODS IN MATERIAL SCIENCE

Course Title:	**Computational Methods in Material Science**
Course Code	**REM 5932**
NQF Level	9
Contact Hours	2 lectures per week for one semester and and 18h (cumulative) practical
NQF Credits	24
Continuous Assessment	A minimum of two tests which counts 40%, Laboratory Mark (or Mini project) counts 50%, at least 2 presentations which counts 10%, Examination: 1x3hr examination. Final Mark: 50% CA mark and 50% Examination mark
Prerequisite	**None**

Course Descriptor: Introduction to computational materials science. Multi-scale simulation methods; electronic structure, atomistic, micro-structure, continuum, and mathematical analysis methods; rate processes and rare events. Materials defect theory; modeling of crystal defects, solid micro-structures, fluids, polymers, and bio-polymers. Materials scaling theory: phase transition, dimensionality, and localization. Perspectives on predictive materials design.

REM5952 ELECTROCERAMICS, ELECTRONIC, OPTICAL, MAGNETIC AND CHARACTERIZATION OF MATERIALS

Course Title:	**Electroceramics, Electronic, Optical, Magnetic and Characterization of Materials**
Course Code	**REM5952**
NQF Level	9
Contact Hours	2 lectures per week for one semester and and 18h (cumulative) practical
NQF Credits	24
Continuous Assessment	A minimum of two tests which counts 70%, Laboratory Mark (or Mini project) counts 20%, at least 2 presentations which counts 10%, Examination: 1x3hr examination. Final Mark: 50% CA mark and 50% Examination mark
Prerequisite	**None**

Course Descriptor: This course will explore the structure property relationships and phenomena in ceramic materials used in electronic, dielectric, ferroelectric, magnetic, and electrochemical applications. In particular, discover how to functionalize a component for a particular application- a capacitor, a thermistor, actuator, or a fuel cell. Such a discovery process demands an in-depth understanding of the roles and interrelationships between the crystal structure, defect chemistry, microstructure, and texture in such materials. Statistical thermodynamics, quantum mechanics, and solid mechanics principles will be used when necessary in the course. Fit in the space and act as a bridge between solid state theory where the emphasis is largely on theory and a ceramic materials course where the emphasis is largely on processing. The study of the crystal structure, crystal diffraction and the related techniques used as diagnostic tools; the electronic, thermal, optical and magnetic properties of material systems important for electronics and photonics device applications. The theory of superconductivity, the chemistry aspects of solid state materials and will provide an introduction to solid state biophysics. The properties of semiconductor materials and semiconductor devices with its focus on technologically relevant structural, optical, thermal and magnetic material properties.

REP5932 CHARACTERIZATION OF PHOTOVOLTAIC DEVICES

Course Title:	**Characterization of Photovoltaic Devices**
Course Code	**REP 5932**
NQF Level	9
Contact Hours	2 lectures per week for one semester and and 18h (cumulative) practical
NQF Credits	24
Continuous Assessment	A minimum of two tests which counts 40%, Laboratory Mark (or Mini project) counts 50%, at least 2 presentations which counts 10%, Examination: 1x3hr examination. Final Mark: 50% CA mark and 50% Examination mark
Prerequisite	**None**

Course Descriptor: Properties of light, irradiance, space and terrestrial solar radiation; atmospheric effects; motion of the sun-declination, elevation, azimuth; solar radiation on tilted surface; measurement of solar radiation; instrumentation; solar radiation databases. Solar cell and module characterization techniques, measurement of cell efficiency, IV characterization, optical characterization, carrier lifetime measurement, electroluminescence; thermography; instrumentation.

REP5952 PHOTOVOLTAIC SYSTEMS

Course Title:	**Photovoltaic Systems**
Course Code	**REP 5952**
NQF Level	9
Contact Hours	2 lectures per week for one semester and and 18h (cumulative) practical
NQF Credits	24
Continuous Assessment	A minimum of two tests which counts 50%, Laboratory Mark (or Mini project) counts 40%, at least 2 presentations which counts 10%, Examination: 1x3hr examination. Final Mark: 50% CA mark and 50% Examination mark
Prerequisite	**None**

Course Descriptor: Properties of light, irradiance, extra-terrestrial and terrestrial solar radiation; atmospheric effects; motion of the sun-declination, elevation, azimuth; solar radiation on tilted surface; measurement of solar radiation; instrumentation; solar radiation databases. Solar modules: module structure and characteristics, mismatch effects, shading, hot-spots, bypass diodes; temperature effects; module degradation; PV arrays: solar generator, Balance of System (BOS) components: batteries; inverters, charge controllers; types of PV systems: grid-connected and stand-alone PV systems, PV systems sizing and installation; systems performance characteristics; care and maintenance, Introduction to suitable design and simulation software; life-time costing.

SECOND YEAR

CHB5900/ CHM5900/ MRE 5900 MSC THESIS

Course Title:	**MSc Thesis**
Course	**CHM5900/ MRE590**
NQF Level	9
Contact Hours	Face to face consultations with supervisor(s) on regular bases
NQF Credits	120
Continuon Assessment	**Final Mark: 100%** CA mark
Prerequisite	Pass in all year 1 courses is required before a student can start with the research project.
Course Assessment:	A candidate must first successfully complete the coursework examinations before commencing thesis work. The thesis must be drafted in English language and submitted to the supervisor. It must be in a format given by the coordinators. The thesis will be evaluated by the supervisor and another examiner within one month after submission. The UNAM grading system will be used for the evaluation. Each student will defend the thesis in a viva voce examination. Refer to the General Information and Regulations Prospectus for detailed information.

Course Descriptor**:** Students will present their findings in the form of a written thesis. Poster and seminar presentations are encouraged. This course tests a student's ability to design and implement a research programme, and communicate the findings to an informed audience in a comprehensive thesis, written in an appropriate scientific style. The timing of assessments and assessment deadlines have been planned to ensure that the volume of work is balanced throughout the programme. These do not only enable students to acquire in-depth practical training under the supervision of experienced research staff but they also help to develop their capacity for independent investigation and report writing. Most projects are laboratory-based although some data review, computer-based projects may be available. Research projects are carried out for a minimum period of 1 year for full time students or 2 years for part time students.

H.8. PHD PHYSICS (11DPSC)

This doctorate programme in Physics has been **fully accredited** by the Namibian Council for Higher Education (NCHE) for a period of 6 years.

H.8.1. REGULATIONS

H.8.1.1. ADMISSION REQUIREMENTS

The entry requirements for are the posession of a NQF level 9 masters degree from a recognized institution as well as a well-written concept note developed together with a prospective supervisor in the Department of Physics

H.8.1.2. DURATION OF STUDY

The duration of the programme is normally three (3) years for full-time students and four (4) years for part-time students.

H.8.2. ADDITIONAL INFORMATION

Additional information can be found in the prospectus of the Centre for Postgraduat Studies

H.9 MSC AND PHD CHEMISTRY BY THESIS

H.9.1. ADMISSION REQUIREMENTS

Student must be in posession of NQF level 8 Honours degree to be addimited for MSc by thesis or NQF level 9 masters degree for PHD by theisis from a recognized institution. In addition, students must submit a well-written concept note developed together with a prospective supervisor in the Department of Cehmistry and Biochemistry.

H.9.2. DURATION OF STUDY

The duration of the programme for MSc by thesis is usually two (2) years for full-time studnets and three years for Part-time students. The Duration for PhD students is normally three (3) years for full-time students and four (4) years for part-time students.

H.9.3. ADDITIONAL INFORMATION

Additional information can be found in the prospectus of the Centre for Postgraduat Studies

STS5942	MODELLING SURVIVAL DATA
Course Title:	**MODELLING SURVIVAL DATA**
Code:	**STS5942**
NQF Level:	9
Contact Hours:	42 hours (2 lecture periods per week and 1 practical session per week for one semester)
Credits:	12
Course Assessment:	CA: 50% (40% from at least 2 tests and seminar presentation 10%), Examination 50% (2 hours examination paper)
Prerequisites:	**None**

Course description: Censoring mechanisms; likelihood construction under non-informative censoring; piecewise constant hazard model; Non-parametric estimators for survival and cumulative hazard functions and their properties; hypothesis testing; Parametric survival models: exponential, gamma, Weibull, Gompertz models; Cox regression models: Proportional hazards models; Cox partial likelihood; Nested case-control studies; conditional logistic regression; Diagnostics for Cox model; Model selection; Prognostic modeling and validation of the prediction; Further topics on Cox regression: Time-dependent covariates; multistate models; Controlling for confounding; Marginal structural Cox models; Stratified Cox regression; Multivariate survival analysis; Regression models for cause-specific and transition hazard; Recurrent events, Competing risk events and Frailty models.

SECOND YEAR COURSES

FIRST AND SECOND SEMESTERS

STM5980	MSc THESIS
Course Title:	**MSc THESIS**
Code:	**STM5980**
NQF Level:	9
Contact Hours:	The module will be facilitated through learning activities such as presentation, discussion and supervision of the research project.
Credits:	120
Course Assessment	The assessment strategy is through 100% Thesis.
Prerequisites:	Passing of at least 80% of Year 1 modules or 96 credits including STS5921 (Research Methodology)

Course description: The module aims to enable students to independently conduct research which contributes to knowledge in a field covered by the degree programme. Upon completion of the module students should be able to: Develop skills of research, problem solving, analysis, synthesis and academic writing; Apply computer based analytical techniques to solve research questions identified in the project; Apply the knowledge that they have learnt through the taught modules to a new substantive area; Communicate effectively through written and oral presentation. A student will be expected to choose a topic under the guidance of a supervisor and undertake research. Students will be expected to demonstrate key research steps including information gathering, analysis and interpretation. They will be expected to demonstrate statistical and demographic techniques to a real research problem.

I. B.SC. WILDLIFE MANAGEMENT & ECOTOURISM (HONS) [17BSWM]

All modules listed below, except English Communication and Study Skills, English for Academic Purposes and Contemporary Social Issues, will be offered by Faculty of Science. English Communication and Study Skills, English for Academic Purposes, Contemporary Social Issues and Computer Literacy are University Core Modules taken by all First Year University of Namibia students.

I.1 GENERAL ADMISSION CRITERIA FOR UNDERGRADUATE PROGRAMMES

I.1.2. B Sc in Integrated Environmental Science (Hons) and B Sc in Wildlife Management & Ecotourism (Hons): Candidates must have obtained a "C" symbol in Mathematics and Biology, and at least a "D" symbol in Geography, Physical Science, Chemistry or Physics.

I.2. DURATION OF STUDY (UNDERGRADUATE PROGRAMMES)

I.2.1 Subject to the provisions of Faculty Special Regulations the minimum duration of full-time study for a Bachelor's degree shall normally be four years, and that of the Diploma normally three years.

I.2.2 Subject to the provisions of Faculty Special Regulations the minimum duration of full-time study for a Bachelor's degree in Veterinary Medicine shall normally be six years.

I.2.3 The maximum period of full-time study for a Bachelor's degree or a Diploma, is the minimum full-time period of study for that Degree or Diploma plus two years.

I.3 ASSESSMENT

UNDERGRADUATE DEGREE PROGRAMMES

Continuous assessment mark will constitute a weighting of 60% of the final mark while examination will constitute
A weighting of 40% of the final mark for modules consisting of the lectures and practicals

I.3.1 Continuous Assessment will include at least 2 written tests and 1 assignment, including practical reports.
I.1.2 Assessment descriptions for the BACHELOR OF VETERINARY MEDICINE is described in the modules descriptors under "L".
I.1.3 MINIMUM REQUIREMENTS FOR RE-ADMISSION INTO THE FACULTY

To be re-admitted into the Faculty, a student must have passed the minimum number of credits as indicated below
By programmes:

I.4 BACHELOR OF SCIENCE IN WILDLIFE MANAGEMENT & ECOTOURISM (HONOURS)

To be re-admitted into the BSc (WME) programme, a student must have passed at least:

(a) 48 credits by the end of the 1st Year, of which 16 is non-Unam core;
(b) 160 credit by the end of the 2nd Year;
(c) 256 credits by the end of the 3rd Year;
(d) 344 credits by the end of the 4th Year;
(e) 408 credits by the end of the 5th Year.

I.5 ACADEMIC ADVANCEMENT REGULATIONS

A student advances to the following academic year of study have to fulfill the following criteria as stated by programs below. In all cases, pre-requisites for modules have to be passed before a student can proceed to register for modules that require prerequisites.

I.5.1 BACHELOR OF SCIENCE IN WILDLIFE MANAGEMENT & ECOTOURISM (HONOURS)

I.5.1.1 First Year to Second Year

(a) To proceed to second year, a student must have passed at least 96 credits prescribed in the first year (67% of the total 136 credits in year 1).
(b) A student who has obtained at least 48 but less than 56 credits by the end of the first year shall not progress to second year, but re-register for all outstanding first year modules. Such student will not be allowed to register for any modules in the second year.
(c) A student who has obtained at least 56 but less than 96 credits by the end of first year shall repeat the year, but will be allowed to register for a maximum of 48 credits in the 2nd year in addition to the failed modules provided that the relevant pre-requisites have been passed.

I.5.2 Second Year to Third Year

(a) To proceed to third year, **a student must have passed at least 50% of the remaining first year credits**, and **at least 112 credits of second year (75% of the total 148 credits in second year**).

(b) A student who has obtained at least **48 but less than 56 second year credits** by the end of the second year shall repeat the year and **re-register for all outstanding modules in the first year**. Such student will not be allowed to register for any modules in the third year.

(c) A student who has obtained at least **56 but less than 112 second year shall repeat the year**, but will be allowed to **register for a maximum of 48 credits** in the third year in addition to the failed modules of the second year provided that the relevant pre-requisites have been passed.

I.5.3 Third Year to Fourth Year

(a) To proceed to fourth year, a student **must pass all first year modules** and at least **50% of the remaining second year credits**. In addition, the student must have **passed at least 96 third year credits** (75% of the total 124 credits in third year).

I.6 B.SC. WILDLIFE MANAGEMENT & ECOTOURISM (HONS) [17BSWM]

I.6.1. PROGRAMME SCHEDULE

YEAR 1

CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 1 Semester 1					
CLC3509	Computer Literacy	**5**	8		
LCE3419	English Communication & Study skills	**4**	16		
BLG3511	Introduction to Biology	**5**	16		
GHE3581	Fundamentals of Physical Geography	**5**	16		
MAT3511	Basic Mathematics	**5**	16		
CSI3580	Contemporary Social Issues	**5**	8		
Year 1 Semester 2					
CHM3532	Chemistry for Life Sciences	**5**	8		
BLG3512	Diversity of Life	**5**	16		
GHE3582	Fundamentals of Human Geography	**5**	16		
LEA3519	English for Academic Purposes	**5**	16		
Total Credits			**136**		

YEAR 2

CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 1 Semester 1					
WLM3601	Wildlife Management	**6**	8		
WLM3631	Ecotourism	**6**	16		
WLM3621	Wildlife Nutrition	**6**	8		
WLM3651	Systematic Botany	**6**	16		
WLM3681	Freshwater Ecology	**6**	12		
CRS3681	Biostatistics	**6**	12		
Year 1 Semester					
WLM3632	Wildlife Ecology	**6**	16		
WLM3682	Ornithology	**6**	12		
WLM3602	Mammalogy	**6**	8		
WLM3642	Wildlife Diseases	**6**	8		
WLM3612	Ecology of African Ecosystems	**6**	16		
WLM3662	Geo-informatics for Wildlife Management	**6**	8	CLC3509	
WLE3602	Ethnobotany	**6**	8	WLM3651	
Total Credits			**148**		

YEAR 3

CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 1 Semester 1					
WLM3701	Governance of Wildlife Resources	**7**	8	WLM3601	
WLM3781	Wildlife Conservation	**7**	12	GHE3582	
WLM3721	Ecological Methods in Wildlife Studies	**7**	8	WLM3632	
WLM3741	National Parks & Game Reserves	**7**	8	WLM3781	
WLM3712	Animal Behaviour	**7**	16	WLM3682 **&** WLM3602	
ACA 3701	Field Attachment I	**7**	8		
Year 1 Semester					
WLM3702	Genetic Conservation	**7**	8	WLM3781	
WLM3722	Wildlife Survey & Monitoring Techniques	**7**	8		
WLM3742	Habitat Management	**7**	8	WLM3781 **&** WLM3601	
WLM3732	Systematics of Birds and Mammals	**7**	16	WLM3682 **&** WLM3602	
WLM3782	Herpetology & Terrarium	**7**	12	WLM3632	
CSC3792	Research Methods	**6**	8	CRS3681	
Total Credits			**124**		

YEAR 4

CODE	COURSE NAME	NQF Level	CREDITS	PRE-REQUISITES	CO-REQUISITES
Year 1 Semester 1					
WLM3801	Freshwater Ichthyology & Aquaculture	**8**	8	WLM3681	
WLM3811	Entomology	**8**	16	BLG 3512	
WLM3821	Economics of Wildlife Resources	**8**	8		
WLM3881	Environmental Impact Analysis	**8**	12		
ACA3801	Field Attachment II	**8**	8		
WLM3810	Research Project	**8**	16		
Year 1 Semester					
WLM3802	Ecotourism Marketing and Travel Plan Development	**8**	8		
WLM3822	Wildlife in Agriculture Ecosystems	**8**	8		
WLM3882	Biogeography	**8**	12	WLM3662	
WLM3841	Digital Wildlife Photography	**8**	8		
WLM3842	Environmental & Ecotourism Education	**8**	8	CSI3580	
WLM3810	Research Project	**8**	16	CSC3792	
Total Credits			**128**		

I.7 MODULE DESCRIPTORS

I.7.1 FIRST YEAR MODULES

CLC3509 COMPUTER LITERACY

Module Title: COMPUTER LITERACY
Code: CLC3509
NQF level: 5
Contact hours: 1 lecture theory and 1 lecture practical per week for 14 weeks
Credits: 8
Module assessment: Continuous Assessment 100%: 2 Practical Tests 50%, 2 Theory Tests 50%
Prerequisites: University Entry

Module Content:

The module covers the following topics. Introduction to Computers: hardware and software, types and categories of computers, usage of Computer devices and peripherals. Working with the windows operating system: File Management, working with multiple programs, using the recycle bin. Using a word processor: formatting a text and documents, spelling check, grammar and thesaurus tools, inserting tables, auto-shapes, clip arts, charts, and mail merge. Spreadsheet: worksheets and workbooks, ranges, formulas and functions, creating graphs, charts, and printing the workbook. Databases: creating tables, relationships, queries, forms and reports. Presentation software: slide layout and master, animations, auto-content wizard and templates. Communication tools: introduction to the Internet, web browsers, search engines, downloading and uploading files, creating and sending messages, email etiquette, internet security, and digital signatures.

LCE3419 ENGLISH COMMUNICATION & STUDY SKILLS

Module Title: ENGLISH COMMUNICATION AND STUDY SKILLS
Code: LCE3419
NQF Level: 4
Contact hours: 4 hours per week for 14 weeks
Credits: 16
Module Assessment: Continuous assessment (60%): two tests (reading and writing), two reading assignments, one oral presentation Examination (40%): one three hour examination paper
Pre-requisites: None

Module Content:

This module is aimed at assisting students in the development of their reading, writing and speaking and listening skills, in order to cope with studying in a new academic environment and in a language which may not be their first language. The module also focuses on study skills that students need throughout their academic careers and beyond. The module serves as an introduction to university level academics, where styles of teaching and learning differ from those at secondary schools in that more responsibility is placed on the student. The module therefore, focuses on the skills that students need throughout their academic careers and beyond.

CSI3580 CONTEMPORARY SOCIAL ISSUES

Module Title: Contemporary Social Issues
Code CSI 3580
NQF Level: 5
Contact hours: Equivalent to 1 hour per week for two semesters **(Online)**
NQF Credits: 8
Prerequisite: None (University Core Module)
Compulsory/Elective Compulsory
Semester Offered: 1 & 2 (Year Module)
Module Descriptor (Rationale of the module):

The module, Contemporary Social Issues (CSI3580), is designed to encourage behavioural change among UNAM students and inculcate the primacy of moral reasoning in their social relations and their academic lives. In providing students with critical and analytical thinking the module enables students to grow and develop into well rounded citizens, capable of solving contemporary social challenges experienced in their communities and societies. The teaching of the module takes three dimensions: the intellectual, the professional and the personal dimensions. The intellectual dimension is fostered through engaging students with subject knowledge, independent learning and module assessment. The professional dimension, on the other hand, is fostered through exposing students to real life situations of case studies and practical exercises that draws attention to social issues that attract ongoing political, public and media attention and/or debate. Finally, the professional dimension is fostered through group work, online discussions and class participation.

BLG 3511: INTRODUCTION TO BIOLOGY

Module Title:	INTRODUCTION TO BIOLOGY
Code:	BLG 3511
Course Equivalent:	Biology 1A
NQF level:	4
Contact hours:	4 lectures/ week for 14 weeks and one 3-hour practical session per week.
Credits:	16
Module assessment:	Continuous assessment (40%): Theory (not less than 3 tests and 2 assignments), 40%. Practical (not less than 10 marked assignment), 60%. Examination (60%): 3 hour examination paper.
Prerequisites:	NSCC (Biology C or better)

Module Content:

It will consider organization of life, chemical basis of life, carbohydrates, proteins, nucleic acids, lipids and fats, water, cell structure and function, prokaryotic and eukaryotic cells, ultra-structure of plant and animal cells, cytoskeleton, membrane structure and function, cell communication, mitosis, meiosis, cell reproduction, cell cycle, and cell death.

The following topics will be covered: Introduction to systems of classification, taxonomy and binomial nomenclature, including the five kingdoms and the three domein system. Definitions and categories/groups within the five kingdoms, evolution by natural selection (microevolution vs macroevolution), phylogeny and evolutionary relationships in five kingdoms. The course content will also include genes, chromosomes, genomes, Mendelian genetics, extensions to Mendelian genetics, chromosome theory of inheritance, linkage and cross-over, recombination, sex determination. The course content will also cover an introduction to Ecology: Definitions, history, scales in ecology, application of ecology. Conditions and Resources: Environmental conditions, animals and their resources, plants and their resources.

MAT 3511: BASIC MATHEMATICS

Module Title:	BASIC MATHEMATICS
Code:	MAT 3511
NQF level:	5
Contact hours:	4 lectures per week for 14 weeks; 2 tutorials per week for 14 weeks
Credits:	16
Module Assessment:	Continuous assessment 50% (at least 3 tests), examination 50% (3 hours examination paper).
Prerequisite:	NSSC Mathematics

Module Content:

Sets: notations and diagrams to represent sets, subset, empty set, equality of sets, intersection, union, complement.

Algebraic expressions: simplification, expansion, polynomials, reminder and factor theorem, partial fractions.

Trigonometry: trigonometric functions, basic trigonometric identities. The absolute value, linear equations, linear inequalities, quadratic equations, the quadratic formula, quadratic inequalities. Functions: domain, codomain, image, preimage, even function, odd function. Sequences: the general term, the geometric sequence, the arithmetic sequence. The Binomial Theorem.

GHE 3581: FUNDAMENTALS OF PHYSICAL GEOGRAPHY

Module Title:	Fundamentals of Physical Geography
Code:	GHE 3581
Proposed NQF Level:	5
Contact Hours:	3 hours/weeks over 14 weeks = 42 contact hours
Credits:	2

Module Content:

Students acquaint themselves with the essential foundations of Physical Geography, including common links to auxiliary disciplines and fields of study. The course presents structures, functions, processes and distributional patterns inherent in phenomena of "natural" environments, relating to climate, geomorphology, hydrology, soils and vegetation. The content focuses on the interrelationship of geo-ecosystems, including the human factor. With particular reference to Namibian conditions, the course offers fundamental applications of concepts inherent in the functioning of the atmo-, litho-, hydro- and biosphere.

Module Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

LEA3519 ENGLISH FOR ACADEMIC PURPOSES

Module Title:	ENGLISH FOR ACADEMIC PURPOSES
Code:	LEA3519
NQF level:	5
Contact hours:	4 periods per week for 14 weeks
Credits:	16
Module assessment:	Continuous assessment (60%): 2 tests (reading and writing), 1 academic written essay,1 oral Presentation Examination (40%) : One three hour examination paper
Prerequisites:	None

Module Content:

This module develops a student's understanding, and competencies regarding academic conventions such as academic reading, writing, listening and oral presentation skills for academic purposes. Students are required to produce a referenced and researched essay written in formal academic style within the context of their university studies. Students are also required to do oral presentations based on their essays. The reading component of the course deals with academic level texts. This involves students in a detailed critical analysis of such texts. The main aim is therefore, to develop academic literacy in English.

CHM 3532: CHEMISTRY FOR LIFE SCIENCES

Module Title:	CHEMISTRY FOR LIFE SCIENCES
Code:	SCHM3532
NQF Level:	5
Contact Hours:	56 hours of lectures, 42 hours of practical sessions.
Credits:	16
Module Assessment:	CA: 50% (minimum 3 tests 80%, laboratory component 20%, tutorial assignments 10%). Final Exam: 50%; (1 x 3 hour exam paper)
Pre-requisites:	None

Module Aims:
This module is designed for students that have insufficient background in chemistry and for non-chemistry majors .It is an introduction to topics in general and organic chemistry, and biochemistry. The following will be covered:
Module Content:
Classification of Matter: Mixtures and Pure substances; Physical States of Matter; Physical and Chemical Properties.
Extensive and Intensive properties. Measurements: Units, Significant figures; Precision and Accuracy, Factor Label Method. Atomic structure and the Periodic table; Electron configuration; Physical and Chemical properties as predicted from groups. Ionic compounds and Molecular compounds: Writing chemical formulae and naming of ionic and molecular compounds. Average Atomic Mass. The Mole Concept; Percent Composition, Empirical formula and Molecular formula. Stoichiometry: limiting reagent, percent yield. Solutions: electrolytes and non-electrolytes, aqueous solutions, ionic equations; concentrations: percent concentration; molarity, molality; dilution of solutions; structure and solubility. Types of bonds; Lewis structures; Resonance structures; Molecular geometry: the VSEPR model, Polarity of molecules. Acid-base equilibrium: properties of acids and bases; relations of acids and bases, self ionisation of water; strengths of acids and bases; the pH scale; hydrolysis of salts; buffers; acid-base titration. Introduction to organic chemistry: organic compounds; structural formulae and conformations; functional groups; Classes of hydrocarbons: alkanes, cycloalkanes: alkanes; alkenes and alkynes; oxidation and reduction; addition reactions; stereo-isomerism. Alcohols, phenols, thiols, ethers: organic compounds of oxygen; common alcohols and phenols. Carboxylic acids and esters, amines and amides: Introduction to carbohydrates, lipids and porphyrins.

BLG 3512: DIVERSITY OF LIFE

Module Title:	DIVERSITY OF LIFE
Code:	SBLG 3512
Course Equivalent:	NSSC (/HIGH GRADE) Biology
NQF level:	5
Contact hours:	4 lecture periods / week for 14 weeks and one three hour practical session per week
Credits:	16
Module assessment:	Continuous assessment: Theory (not less than 3 tests and 2 Assignments) 40% Practical (not less that 10 marked assignments) 50% Examination: 60% (1 x 2 hour examination paper)
Prerequisites:	NSCC (Biology C or better)

Module Content:
This module is designed to give students a detailed understanding of the diversity of life. It gives students the broader appreciation of biodiversity in the different ecological habitats. The course shall describe diagnostic characteristics of principle taxonomic categories for each phylum. Coverage of each Phylum shall follow a phylogenetic (evolutionary) approach as well as introduce broad ecological and physiological principles. Various aspects of reproduction and development shall be highlighted. This module prepares students to understand subsequent courses such as Introduction to Ecology and Microbiology, Population Ecology, Comparative physiology, Biogeography, Plant and Animal Form and Function

Topics covered will include viral, bacterial, fungal, algal, animal and plant diversity. It then considers the characteristics and life cycles of the following important algae, animal and plant groups: Chlorophyta, Phaeophyta, Rhodophyta, Chrysophyta, Euglenophyta, Pyrrophyta, Cryptophyta, Protostomate phyla: Nemertea, Mollusca, Anellida, Arthropoda, Nematoda, Rotifera, Lophophorates, Onychophora. Deuterostomate phyla: Echinodermata, Hemichordata and Chordata (Subphyla: Urochordata, Cephalochordata and Vertebrata: Class Myxiniformes, Petromyzontiformes, Placoderms, Chodrichthyes, Actinopterygii, Actinistia, Dipnoi, Amphibia, Reptilia, Aves, Mammalia) bryophytes, seedless vascular plants, gymnosperms, and the angiosperms. Concepts such as Homology and analogy; body symmetry (radial, bilateral), cephalisation, body cavities: diploblastic, triploblastic (acoelomate and coelomate [deuterostomes and protostomes]) will be covered.
Examples from Namibia shall be used where possible and applicable. The course content shall be supplemented with appropriate weekly practical sessions in the laboratory and in the field.

I.7.2 SECOND YEAR MODULES

WLM 3632: WILDLIFE ECOLOGY

Module Title:	WILDLIFE ECOLOGY
Code	WLM 3632
NQF Level	6
Contact hours	lectures: 4 x 1hr/wk for 14 weeks (56hrs); practical: 3 hr/week for 14 weeks (42hrs)
NQF Credits	16
Prerequisite	None
Compulsory/elective	Compulsory

Semester offered 1

Module Content:

Concept of ecology. Organism and its environment (adaptation, water and thermal balance, light, soil). Ecosystem ecology: energy flow, biomass, trophic levels, biogeochemical cycles. Major ecosystems of southern Africa, with special reference to Namibia. Community ecology: structure, stability, disturbance, diversity, patterns. Ecological succession. Properties of populations: distribution, densities, age and sex structure, mortality and natality, survival, migration and immigration. Population regulation. Interspecific relationships: competition, predation, commensalism, amensalism, mutualism. Feeding niche. Life histories patters

Assessment strategies

Continuous assessment: 50% (at least 2 tests, practical assessments); Exam: 50% (1 x 3 hr paper).

WLM 3601: WILDLIFE MANAGEMENT

Module Title:	WILDLIFE MANAGEMENT
Code	WLM 3601
NQF Level	6
Contact hours	lectures: 2 x 1hr/wk for 14 weeks (28hrs); practical: 1 x 2hr alternate for 14 weeks (14hrs)
NQF Credits	8
Prerequisite	none
Compulsory/elective	compulsory
Semester offered	1

Module Content:

An introduction to basic principles used in the management of wildlife populations, their habitats and their human users. General concepts in ecological processes; population dynamics and structure; life history patterns, biotic and abiotic factors structuring wildlife populations and endangered species. Response of wildlife to human. Plant-herbivore system. Herbivore-carnivore system. Predation of domestic animals and by domestic animals. Wildlife species and their characteristics: antelope and other smaller herbivores, large herbivores, predators, ostriches, combining wild and domestic herbivores. Game ranch planning: fences, water holes, roads. Wildlife management techniques. Harvesting, hunting and capturing wild animals. Handling and measuring trophies. Wildlife management and rural development.

Assessment strategies

Continuous assessment: 40% (at least three assessments); Exam: 60% (1 x 2 hr paper)

WLM 3631: ECOTOURISM

Module Title:	ECOTOURISM
Code	WLM 3631
NQF Level	6
Contact hours	lectures: 4 x 1hr/wk for 14 weeks (56hrs); practical: 3 hr/week for 14 weeks (42hrs)
NQF credits	16
Prerequisite	GHE3511: fundamentals of physical geography
Compulsory/elective	compulsory
Semester offered	1

Module Content:

Major goals of ecotourism; tourism and wildlife habituation; negative impact of wildlife tourism; field guiding practice; forms of ecotourism: angling, trophy-hunting, bird-watching, marine and coastline tourism, primitive camping; ecotourism internship; hospitality and ecotourism development.

Assessment strategies

Continuous assessment: 40% (at least three assessments, practical assessments); Exam: 60% (1 x 3 hr paper)

WLM 3651: SYSTEMATIC BOTANY

Module Title:	SYSTEMATIC BOTANY
Code	WLM 3651
NQF Level	6
Contact Hours	Lectures: 4X 1hr/Wk For 14 Weeks (56hrs); Practical: 3 X 3hr for 14 Weeks (42hrs)
NQF Credits	12
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:

Introduction to plant taxonomy. Plant anatomy and morphology. Taxonomic concepts, plant classification, nomenclature. Trees, shrubs, grass and herbs identification. Botanical keys: types and use. Specimen collection. Major plant families in southern Africa, with special reference to Namibia.

Assessment strategies

Continuous assessment: 50% (at least three tests, practical assessments); Exam: 50% (1 x 3 hr paper)

WLM 3681: FRESHWATER ECOLOGY

Module Title:	FRESHWATER ECOLOGY
Code	WLM 3681
NQF Level	6
Contact Hours	Lectures: 3 X 1hr/Wk For 14 Weeks (42hrs); Practical: 1 X 3hr Alternate For 14 Weeks (21hrs)
NQF Credits	12
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:
Abiotic parameters influencing productivity of aquatic ecosystems. Diversity, structure and functioning of various community structures: phytoplankton, zooplankton and benthos. Direct and indirect interactions between the biotic and abiotic components of the aquatic ecosystems. Intespecific relationships. Reproduction tactics, growth, survival and fecundity of producers and consumers. Aquatic ecosystems of Namibia and other SADAC countries. Management and conservation of aquatic habitats
Assessment Strategies
Continuous assessment: 50% (at least three assessments); Exam: 50% (1 x 3 hr paper)

AWLM 3682: ORNITHOLOGY

Module Title:	ORNITHOLOGY
Code	WLM 3682
NQF Level	6
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	12
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:
Ornithology as science. Anatomy and morphology. Eco-physiology. Distribution, demography and habitat selection. Territoriality versus coloniality. Avian communities. Reproductive biology and ecology. Breeding strategies (mating systems, brood parasitism, co-operative breeding). Feeding ecology. Biogeography. Migration. Bird conservation.
Assessment strategies
Continuous assessment: 40% (at least three assessments); Exam: 60% (1 x 3 hr paper)

WLM 3602: MAMMALOGY

Module Title :	MAMMALOGY
Code	WLM 3602
NQF Level	6
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practicals: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:
Comparative anatomy and physiology. Distribution, numbers and habitat selection. Reproductive biology and ecology. Feeding ecology. Communication, orientation and echolocation. Life cycles. Climatic adaptations. Natural and human threats to habitats of mammal. Conservation strategies.
Assessment strategies
Continuous assessment: 50% (at least three assessments); Exam: 50% (1 x 2 hr paper)

WLM 3622: WILDLIFE NUTRITION

Module Title:	WILDLIFE NUTRITION
Code	WLM 3622
NQF Level	6
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:
Anatomy and physiology of digestive system; digestion in herbivores; feeding ecology of wildlife species; diet composition and analysis; nutritional value of plants; plant chemicals and toxins; management of toxic plants and affected game; water quality and water requirements; mineral deficiencies and supplementary feeding; nutrition in captivity.
Assessment strategies
Continuous assessment: 50% (at least three assessments); Exam: 50% (1 x 2 hr paper)

WLM 3642: WILDLIFE DISEASE

Module Title:	WILDLIFE DISEASE
Code	WLM 3642
NQF Level	6
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:
General principles. Recent advances of immunology. Viral, bacterial and protozoan diseases; ecto- and endoparasites (pathology, diagnosis, treatment and control). Epizootia and enzootia. Wildlife diseases investigation, preventive medicine. Physical and chemical restraint and anesthesia. Aspects of wildlife surgery.
Assessment Strategies
Continuous assessment: 50% (at least two tests, practical assessments); Exam: 50% (1 x 2 hr paper)

WLS 3612: ECOLOGY OF AFRICAN ECOSYSTEMS

Module Title:	ECOLOGY OF AFRICAN ECOSYSTEMS
Code	WLS 3612
NQF Level	6
Contact Hours	Lectures: 4 X 1hr/Wk For 14 Weeks (56hrs); Practical: 3 Hr/Week For 14 Weeks (42hrs)
NQF Credits	16
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:
Distribution of savanna biomes in Africa. Determinants of savanna structure and function: water, soil, nutrients, fire, herbivory. Vegetation of savanna: rich versus poor savanna. Energy flow and food web. Biodiversity of savanna. Tree-grass and predator-prey interactions. Competition and mutualistic relationships. Population models. Managing savanna. Distribution of desert and semidesert biomes in Africa. Determinants of desert and semidesert structure and function: water, soil, nutrients, herbivory. Animal adaptations to live in desert. Vegetation of desert and semidesert. Energy flow and food web. Biodiversity of desert and semidesert. Interspecific relationships. Population models. Managing desert and semidesert.
Assessment strategies
Continuous assessment: 40% (at least three assessments); Exam: 60% (1 x 3 hr paper)

WLM 3662: GEO-INFORMATICS FOR WILDLIFE MANAGEMENT

Module Title:	GEO-INFORMATICS FOR WILDLIFE MANAGEMENT
Code	WLM 3662
NQF Level	6
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	CLC3409: Computer Literacy; Hghe3511: Fundamentals Of Physical Geography
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content
Basic concepts, GIS data structures, processing and analysis techniques, basic cartography, map projections, introduction to GPS, basic aerial photograph interpretation. Use of GIS software. Use of GPS receiver. Display and manipulation of image files. Remote sensing for wildlife management, rangeland and vegetation monitoring.
Assessment strategies
Continuous assessment: 50% (at least two tests, practical assessments); Exam: 50% (1 x 2 hr paper)

CRS 3681: BIOSTATISTICS

Module Title:	BIOSTATISTICS
Code	CRS 3681
NQF Level	7
Contact Hours	Lectures: 3x 1hr/Wk For 14 Weeks (42hrs); Practical: 1 X 3hr Alternate Wk For 14 Weeks (21hrs)
NQF Credits	12
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	2

Assessment Strategies
Continuous Assessment: 50% (minimum of 2 tests, a marked assignment and 5 marked practicals); Examination: 50% (1 x 2 hr paper).

WLE 3602: ETHNOBOTANY

Module Title:	ETHNOBOTANY
Code	WLE 3602
NQF Level	7
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	WLM 3651 SYSTEMATIC BOTANY
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:
Useful and toxic plants, their origin and history of plant use. Plant products and derivatives used in nutrition, medicine, building-construction, clothing. Potentials for new crop species. Utilization indigenous versus exotic plants.
Assessment Strategies
Continuous assessment: 50% (at least two tests, practical assessments); Exam: 50% (1 x 2 hr paper)

I.7.3 THIRD YEAR MODULES

WLM 3701: GOVERNANCE OF WILDLIFE RESOURCES

Module Title:	GOVERNANCE OF WILDLIFE RESOURCES
Code	WLM 3701
NQF Level	7
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	WLM 3601: Wildlife Management

Compulsory/Elective Compulsory
Semester Offered 1

Module Content:

Philosophy and law; law and policies concerning regulation of commerce in wildlife; wildlife conservation and management within the legal and policy frameworks governing management of private, communal and state lands; regulation of human-wildlife interactions; tenure regimes and policy framework; constraints to wildlife conservations among resource-poor rural populations.

Assessment Strategies:

Continuous assessment: 50% (at least three assessments); Exam: 50% (1 x 2 hr paper)

WLM 3781: WILDLIFE CONSERRVATION

Module Title:	WILDLIFE CONSERVATION
Code	WLM 3781
NQF Level	7
Contact Hours	Lectures: 3 X 1hr/Wk For 14 Weeks (42hrs); Practical: 1 X 3hr Alternate For 14 Weeks (21hrs)
NQF Credits	12
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:

Concepts of wildlife nature conservation. Values and ethics of wildlife conservation. Species conservation. Extinction and endangered species. Key and charismatic species. National and international forms of area protection for wildlife. Conservation strategies. In situ and ex situ wildlife conservation. Wildlife Conservation and sustainable development. Wildlife conservation in urbanized and agricultural ecosystems. The economics of wildlife conservation. National and international legislation on nature wildlife conservation

Assessment Strategies

Continuous assessment: 50% (at least three assessments); Exam: 50% (1 x 3 hr paper)

WLM 3721: ECOLOGICAL METHODS IN WILDLIFE STUDIES

Module Title:	ECOLOGICAL METHODS IN WILDLIFE STUDIES
Code	WLM 3721
NQF Level	7
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	WLM 3611: Wildlife Ecology
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:

Measuring species diversity, community similarities and niche width and overlap. Quantifying habitat selection. Determining diet composition, prey size and prey quality. Measuring the reproductive success. Determination of proximate causes of breeding failure. Measuring timing of reproduction and annual productivity. Methods of catching wildlife species: cage traps, nets, drugs; sexing, ageing, measuring and determining physical condition. Ringing and radio-tagging.

Assessment Strategies

Continuous assessment: 50% (at least two tests, practical assessments); Exam: 50% (1 x 2 hr paper)

WLM 3741: NATIONAL PARKS & GAME RESERVES

Module Title:	NATIONAL PARKS & GAME RESERVES
Code	WLM 3741
NQF Level	7
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Co-Requisite	WLM 3781: Wildlife Conservation
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content

Role of national parks and game reserves. Principles of management in national parks and game reserves. A review of southern African national parks and game reserves, with special reference to Namibia.

Assessment Strategies

Continuous assessment: 50% (at least two tests, practical assessments); Exam: 50% (1 x 2 hr paper)

WLM 3712: ANIMAL BEHAVIOUR

Module Title:	ANIMAL BEHAVIOUR
Code	WLM 3712
NQF Level	7
Contact Hours	Lectures: 3 X 1hr/Wk For 14 Weeks (42hrs); Practical: 1 X 3hr Alternate For 14 Weeks (21hrs)
NQF Credits	16
Prerequisite	WLM 3682: Ornithology; AWLM 3602: Mammalogy
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:

Simple and complex behaviour. Sign-stimuli, motivation. Conflict behaviour, orientation, learning, genes and behaviour. Anti-predator behavior. Instinct. Behavioural ecology. Feeding behaviour; Social and non-social behaviour; Aggression; Sexual behavior. Effects of environment on breeding. Ungulate and carnivore behavior.

Assessment strategies
Continuous assessment: 50% (at least three assessments); Exam: 50% (1 x 3 hr paper)

WLM 3702: GENETIC CONSERVATION

Module Title:	GENETIC CONSERVATION
Code	WLM 3702
NQF Level	7
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Co-Requisite	WLM 3781: Wildlife Conservation
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:
Introduction to genetic conservation. Genetics and extinction. Characterizing genetic diversity in single loci and by quantitative variation. Evolution in large population: natural selection and adaptation; mutation, migration and their interactions with selection. Evolution in small populations. Maintenance of genetic diversity. Effect of population size reduction: loss of genetic diversity in small populations, inbreeding depression, population fragmentation, genetically viable populations. Resolving taxonomic uncertainties and defining management units. Genetically modified food. Genetic management of wild and captive populations.
Assessment Strategies
Continuous assessment: 50% (at least three assessments); Exam: 50% (1 x 2 hr paper)

WLM 3722: WILDLIFE SURVEY & MONITORING TECHNIQUES

Module Title:	WILDLIFE SURVEY & MONITORING TECHNIQUES
Code	WLM 3722
NQF Level	7
Contact Hours	Lectures: 2 X 1hr/Wk for 14 Weeks (28hrs); Practical: 1 X 2hr Alternate for 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:
General principles of surveys and monitoring; the purpose of surveying and monitoring; an outline of basic techniques; Bird survey and monitoring techniques (census, atlas studies, territory mapping, line transects, point counts, mist netting, capture-mark-release-recapture, response to playback, timed species count, counting nests in colonies, leks, roosts and flocks, counting different groups of birds); mammal survey and monitoring techniques (census, atlas studies, mark-recapture methods, strip and line transects, counting dung, feeding signs, footprints, calls, breeding sites, hair tubes and hair catches, bat roosts, seal colonies; accuracy and precision of counts (sources of error and bias, environmental variables).
Assessment Strategies
Continuous assessment: 50% (at least two tests, practical assessments); Exam: 50% (1 x 2 hr paper)

WLM 3742: HABITAT MANAGEMENT

Module Title:	HABITAT MANAGEMENT
Code	WLM 3742
NQF Level	7
Contact Hours	Lectures: 2 X 1hr/Wk for 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	WLM3611: Wildlife Conservation; AWLM3601: Wildlife Management
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:
Habitat characteristic; habitat diversity, fragmentation, arrangement; changes to habitat (physical, biological, pollution); classification of plant communities; calculation plant biomass; assessing veld conditions; grazing management; bush encroachment; desertification; fire as ecological factor; determining carrying capacity (ecological, grazing and browsing); habitat enrichment and restoration
Assessment Strategies
Continuous assessment: 50% (at least two tests, practical assessments); Exam: 50% (1 x 2 hr paper)

WLM 3732: SYSTEMATICS OF BIRDS & MAMMALS

Module Title:	SYSTEMATICS OF BIRDS & MAMMALS
Code	WLM 3732
NQF Level	7
Contact Hours	Lectures: 4 X 1hr/Wk For 14 Weeks (56hrs); Practical: 3 Hr/Week For 14 Weeks (42hrs)
NQF Credits	16
Prerequisite	WLM3682: Ornithology; AWLM3602: Mammalogy
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content
General taxonomy and nomenclature of birds and mammals. Phylogeny and origin of birds and mammals. Characteristic of avian and mammalian orders and families. Review of bird and mammals species, with special reference to southern African fauna: identification, biology and ecology of selected mammal species.
Assessment Strategies
Continuous assessment: 50% (at least two tests, practical assessments); Exam: 50% (1 x 3 hr paper)

WLM 3782: HERPETOLOGY & TERRARIUM

Module Title:	HERPETOLOGY & TERRARIUM
Code	WLM 3782
NQF Level	7
Contact Hours	Lectures: 3 X 1hr/Wk For 14 Weeks (42hrs); Practical: 1 X 3hr Alternate For 14 Weeks (21hrs)
NQF Credits	12
Prerequisite	WLM3611: Wildlife Ecology
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:

Morphology and anatomy; ecophysiology; movements and orientation. Anuran vocal communication; communication and social behaviour. Mating systems and sexual selection. Reproduction and parental care. Life cycles. Snake bites. Phylogeny and origin of amphibians and reptiles. Characteristic of amphibian and reptile orders and families. Review of amphibian and reptile species, with special reference to southern African fauna: identification, biology and ecology of selected mammal species. Conservation of amphibians and reptiles. Terrarium: obtaining specimens, transporting and handling, enclosures, feeding, captive breeding.

Assessment Strategies

Continuous assessment: 50% (at least two tests, practical assessments); Exam: 50% (1 x 3 hr paper)

CSC 3792: RESEARCH METHODS

Module Title:	RESEARCH METHODS
Code	CSC 3792
NQF Level	7
Contact Hours	Lectures: 3x1h For 14 Weeks (42 Hrs); Practicals: 1x3 Hr Alternate Wk For 14 Weeks (21 Hrs)
NQF Credits	12
Prerequisite	CSC 3692: Biostatistics
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:

Introduction/Review Of Basic Statistical Methods. Comparison Between Non-Parametric And Parametric Statistics. Non-Parametric Statistics: Goodness Of Fit Test, Test Of Association, Chi-Square Test, Paired Comparison, Wilcoxon's Test, Rank Correlation. Regression And Correlation. Multivariate Methods: Multiple Regression, Discriminant Analysis, Canonical Analysis, Multidimensional Scaling, Principal Component Analysis. Introduction To Statistical Computer Packages.

Assessment strategies

Continuous assessment: 50% (at least three assessments); Exam: 50% (1 x 2 hr paper)

I.7.4 FOURTH YEAR MODULES

WLM 3801: FRESHWATER ICHTHYOLOGY & AQUACULTURE

Module Title:	FRESHWATER ICHTHYOLOGY & AQUACULTURE
Code	WLM 3801
NQF Leve	8
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	WLM3681: Freshwater Ecology
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:

Morphology, anatomy and physiology. Factors affecting fish distribution. Fish behavior. Feeding. Reproduction and growth. Migration and movements. Parasites and diseases. Traditional fishing, angling, subsistence fisheries, aquarium and ponds. Aquaculture: biological, engineering and economic factors involved in the establishment and operations of different freshwater aquaculture systems; systems and practices of aquaculture; impact of aquaculture on environment; nutrition, brood-stock management and larval.

Assessment strategies

Continuous assessment: 40% (at least two tests, practical assessments); Exam: 60% (1 x 2 hr paper)

WLM 3811: ENTOMOLOGY

Module Title:	ENTOMOLOGY
Code	WLM 3811
NQF Level	8
Contact Hours	Lectures: 4 X 1hr/Wk For 14 Weeks (56hrs); Practical: 3 Hr/Week For 14 Weeks (42hrs)
NQF Credits	16
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:

Morphology and functional anatomy of insects and arachnids. Movements and locomotion (gaint, jumping, swimming, burrowing, flying). Reproduction and metamorphosis. Camuflage and disruptive forms of illusion. Vocalisation: sound structure, sound function, sound structure). Insect constructions (tunnels, leaf mines, galls, paper and cotton nests, wax and silk, etc.). Insect migration. Insect societies (termites, ants, bees, wasps, etc.). Insect ecology. Role of insects and arachnids: agriculture, forestry, medicine, veterinary, food production. Pest control. Systematic of insects and arachnids, with special reference to Namibian fauna.

Assessment strategies

Continuous assessment: 50% (at least three tests, practical assessments); Exam: 50% (1 x 3 hr paper)

WLM 3821: ECONOMIC OF WILDLIFE RESOURCES

Module Title:	ECONOMIC OF WILDLIFE RESOURCES
Code	WLM 3821
NQF Level	8
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	AWLM3601: Wildlife Management
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:

Typology of wildlife resources. Exploitation rates renewable resources, with emphasis on wildlife cropping. The concept of common property and free access resources. Wildlife on private and public lands. The economic of wildlife ranching. Wildlife species valuation in relation to tourists revenues; wildlife option values. Wildlife versus alternative land uses, e.g. agriculture, forestry and mining. Direct economic value of wildlife.

Assessment strategies

Continuous assessment: 50% (at least three assessments); Exam: 50% (1 x 2 hr paper)

ENE 3881: ENVIRONMENTAL IMPACT ANALYSIS

Module Title:	ENVIRONMENTAL IMPACT ANALYSIS
Code	ENE 3881
NQF Level	8
Contact Hours	Lectures: 3 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	12
Prerequisite	AWLM3611: Wildlife Ecology
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:

Definitions: impact assessment, environmental studies, environmental impact of human activities on natural resources. Impact on atmosphere, water bodies, vegetation and wildlife. Environmental considerations in physical planning. Impact identification, monitoring and mitigation. Methods of identifying impacts, monitoring environmental impacts, and types of mitigation actions. Formal Environmental Impact Assessment. Policy and framework in Namibia.

Assessment strategies

Continuous assessment: Continuous assessment: 50% (at least three assessments); Exam: 50% (1 x 2 hr paper)

ACA 3801: FIELD ATTACHMENT II

Module Title:	FIELD ATTACHMENT II
Code	ACA 3801
NQF Level	8
Contact Hours	6 Weeks
NQF Credits	8
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	1

Module Content:

Students will be attached to national parks, game reserves, conservancies and other wildlife agencies and tourist boards. An attachment report and oral presentation will constitute the total assessment mark.

Assessment strategies:

50% report presentation at a seminar; 50% field report. Subject to satisfactory attendance and conduct during attachment.

WLM 3802: ECOTOURISM MARKETING AND TRAVEL PAN DEVELOPMENT

Module Title:	ECOTOURISM MARKETING AND TRAVEL PAN DEVELOPMENT
Code	WLM 3802
NQF Level	8
Contact Hours	Lectures: 2 X 1hr/Wk for 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:

Ecotourism marketing. Ecotourism Travel Pan Development. Ecotourism internship; impact of ecotourism on rural livelihood and poverty; enclave tourism and ecotourism.

Assessment strategies

Continuous assessment: 50% (at least three assessments); Exam: 50% (1 x 2 hr paper)

WLM 3822: WILDLIFE IN AGRICULTURAL ECOSYTEMS

Module Title:	WILDLIFE IN AGRICULTURAL ECOSYSTEMS
Code	WLM 3822
NQF Level	8
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:
Pressures facing both farmers and wildlife in agricultural ecosystems; trade-offs between food production and wildlife conservation. Wildlife in agriculture ecosystems and rural sociology.
Assessment strategies
Continuous assessment: 50% (at least two tests, practical assessments); Exam: 50% (1 x 2 hr paper)

WLM 3882: BIOGEOGRAPHY

Module Title:	BIOGEOGRAPHY
Code	WLM 3882
NQF Level	8
Contact Hours	Lectures: 3 X 1hr/Wk For 14 Weeks (42hrs); Practical: 1 X 3hr Alternate For 14 Weeks (21hrs)
NQF Credits	12
Prerequisite	WLM3662: Geo-Informatics For Wildlife Management
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:
Main concepts and rules of biogeography. Main biomes of the world, with special reference to Africa. Faunal regions and subregions of the world, with special reference to Africa. Dynamic biogeography. Geographical barriers and island biogeography. Climatic adaptations. Patterns of distributions.
Assessment strategies
Continuous assessment: 50% (at least three assessments); Exam: 50% (1 x 3 hr paper)

WLM 3841: DIGITAL WILDLIFE PHOTOGRAPHY

Module Title:	DIGITAL WILDLIFE PHOTOGRAPHY
Code	WLM 3841
NQF Level	8
Contact Hours	Lectures: 2 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	8
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:
Equipment. Ethics and safety in wildlife photography. Flashing, shading and colouring. Macrophotography: insects, flowers. Underwater photography. Photography in zoological and botanical gardens. Composing pictures. Tonal ranges. Panoramic pictures. Focusing and scanning. Software picture preparations.
Assessment strategies
Continuous assessment: 50% (at least two tests, practical assessments); Exam: 50% (1 x 2 hr paper)

ENE 3842: ENVIRONMENTAL & ECOTOURISM EDUCATION

Module Title:	ENVIRONMENTAL & ECOTOURISM EDUCATION
Code	ENE 3842
NQF Level	8
Contact Hours	Lectures: 3 X 1hr/Wk For 14 Weeks (28hrs); Practical: 1 X 2hr Alternate For 14 Weeks (14hrs)
NQF Credits	12
Prerequisite	None
Compulsory/Elective	Compulsory
Semester Offered	2

Module Content:
General principals of environmental education. Environmental awareness and ethics. Environmental educational institutions: nature history museums, zoological gardens, national parks, reserves. Methods of environmental education. Publicizing and advertising environmental issues. Environmental education in primary and secondary schools. Environmental education in media.
Assessment strategies
Continuous assessment: 50% (at least two tests, practical assessments); Exam: 50% (1 x 2 hr paper)

WLM 3810: RESEARCH PROJECT

Module Title:	RESEARCH PROJECT
Code	AWLM 3810
NQF Level	8
Contact Hours	Individual Student Consultation for 28 Weeks: Equivalent to 1 Hr/Week
NQF Credits	32
Prerequisite	ACSC 3792: Research Methods
Compulsory/Elective	Compulsory
Semester Offered	1 & 2

Module Content:
Senior undergraduate students carry out independent study of a current topic in wildlife ecology. The course include participation in meetings organized by the coordinator, work with a faculty advisor to develop a research project, formulate hypothesis, design and carry out preliminary experiments and collect data and test the hypotheses. Students will carry out independent literature research, begin experimental work, prepare a written report and make a presentation to other students the proposal and final report. The student will submit a final report written following the Guide for Scientific Writing.
Assessment strategies
Continuous assessment: 100% (research proposal write up and presentation of proposal in a seminar, presentation of empirical findings in a second seminar, and grading of the final report).

I.8 (A) BACHELOR OF ARTS IN TOURISM: HERITAGE STUDIES (HONOURS) (13BATM)

I.8.1 BA (TOURISM: HERITAGE STUDIES) (HONS) (13BTHS) (FOR INTERNAL USE ONLY)

I.8.1 Introduction
I.8.3 Admission
In addition to the above, admission to the Tourism, Geography and Environmental Studies courses require at least a D symbol in Mathematics on NSSC level or the equivalent and/or at least a C symbol in Geography at NSSC level or the equivalent.

I.8.4
The University reserves the right to interview students before admission.

I.8.5.
Certain Courses, subjects or programmes may require special written application by and/or screening of candidates before admission is considered. Candidates who do not meet the requirements for admission to such Courses, subjects or programmes may, however, register for any other Courses, subjects or programmes to which they are admitted subject to relevant University and Faculty regulations.

In light of the tourism potential ascribed to Namibia, the qualification of the four-year BA degree in Tourism-Heritage (Honours) programme provides an academic skills-based education for students who intend to enter careers in the tourism-heritage field in areas such as promotion, planning, management or policy-making in tourism-heritage, as well as research and publishing relating to tourism-heritage and culture. The programme subscribes to trans-disciplinary learning paradigms nurtured at UNAM. Its purpose is to establish confidence, capacity and ability to exercise professional judgment pertaining to decision-making, tasks and responsibilities inherent in the private and public sector of tourism- heritage and culture to the benefit of society. The BA degree in tourism- heritage inter alia responds to employment opportunities relating to the sector of tourism-heritage focusing on branding "culture" in addition to "nature" and "landscapes". The BA degree in Tourism- Heritage Studies furthers students' knowledge and skills in the socio-cultural domain, including language, heritage, music, art and history of the Namibian society. Students no longer do communication, so a foreign language course (instead of communication) and presentation training offered in the Faculty constitute an indispensable complement to the programme.

Programme Convenor: Ms E Kimaro (Tel. 206 3716– E-mail: makawa@unam.na)

I.8.6 Exit Objectives
Upon completion of this programme students will be able to:
apply their skills-based knowledge in professional domains of the public and private sector of the tourism industry analyse and evaluate problem formations evolving from institutional, commercial, socio-cultural and environmental tourism activities design professional solutions demonstrate confidence, capacity and ability in professional judgment and decision-making employ professional ethics in dealing with tasks and responsibilities inherent in the private and public sector of the tourism industry to the benefit of society.

I.8.7 Admission
I.8.7.1
Refer to C.1 Admission under C. Regulations Pertaining to Undergraduate Studies in the Faculty in this yearbook.

I.8.7.2
Refer to the admission requirements of the relevant BA language subject that represents the minor subject in this programme (in the BA Subject Regulations and Course Descriptors section of this yearbook).

I.8.7.3 Curriculum Compilation
I.8.7.4 Overall Structure
I.8.7.5
The BA (Tourism) degree is a double-major qualification consisting of two (2) major subjects, i.e. Tourism Management Studies or Heritage Studies and Geography and Environmental Studies taken up to fourth year level, one (1) minor subject (a language subject selected from the BA language subjects in E.1.3.2.1) taken up to third year level, two (2) programme core Courses taken at first year level only, plus the University Core Curriculum Courses at first year level.

I.8.7.6
The BA (Tourism) degree programme consists of a total of 35 Courses (528 credits) at the various year levels in the various subjects as outlined above, all of which a student must pass in order to graduate (cf. C.4.2.1).

I.8.7.7
The overall structure of the BA (Tourism) degree programme can be schematically represented as follows:

Fourth			3 courses	4 courses	
Third		2 courses	3 courses	2 courses	0.5 Course
Second		3 courses	2 courses	3 courses	0.5 Course
First	3 courses*	2 courses	2 courses	4 courses	
Year Level	UNAM Core Curriculum (48 credits)	Language Subject Minor Subject (104 credits)	Geography & Environ. Studies (152 credits)	Heritage Studies Specialization (208 credits)	Tourism Business Internship (16 credits)

**** The University Core Curriculum consists of two (2) Courses and two (2) half-Courses (cf. C.4.3.1).***

I.8.7.8
To be awarded the BA (Tourism) degree, a student must pass all 35 Courses (528 credits) within the curriculum structure as stipulated above.

I.8.7.9
Courses/credits are not horizontally, vertically or laterally transferable.

I.8.7.10. First Year Level

Curriculum Compilation

At first year level students register for the University Core Curriculum courses and the required six (6) Heritage Studies & Geography and Environmental Studies courses. Furthermore, students select one (1) language from the available BA language offerings as minor subject and register for the two (2) required first year level courses in the relevant language, in line with the relevant subject regulations. The normal first year level curriculum of a student registered in the BA (Tourism - Heritage) degree programme will therefore consist of eleven (11) courses (144 credits), compiled as follows:

Subject	Courses	Credits
University Core Curriculum (cf. C.4.3.1)	3	48
Geography and Environmental & Heritage Studies at first year level	6	72
Selected BA language discipline at first year level**	2	24
Total	11	144

***** Students select the BA language subject in line with the relevant subject regulations.***

Curriculum

Students register for all six (6) Courses below:			
Courses	Semester	Code	Course Title
	1	GHE 3581	Fundamentals of Physical Geography*
	2	GHE 3582	Fundamentals of Human Geography*
	1	HGE 3581	African Civilisations
	2	LAC 3582	Language and Culture
	1	GHT 3581	Fundamentals of Tourism Management
	2	GHT 3582	Customer Relations in Tourism
BA Language Subject	Students select one (1) of the language subjects below and register for the corresponding two (2) first year level courses as indicated, in line with the relevant subject regulations. This subject will be taken up to third year level.		

French as Applied and Business Language#	1	LFB 3581	Foundations of French
	2	LFB 3582	French for Beginners
German as Applied and Business Language#	1	LGB 3581	Foundations of German
	2	LGB 3582	German for Beginners
Portuguese as Applied and Business Language#	1	LPB 3581	Foundations of Portuguese
	2	LPB 3582	Portuguese for Beginners
Spanish as Applied and Business Language#	1	LSB 3581	Foundations of Spanish
	2	LSB 3582	Spanish for Beginners

* ***Throughout the academic year, the above courses require three (3) hours practical work per week: Practical 1.***
\# ***Prerequisite: Students should have no prior knowledge of the language that they select. Students who are competent in*** any of these languages may not take them.

I.8.7.11. Second Year Level

Admission Requirements
The Faculty's Student Registration and Academic Advancement Rules apply (cf. C.4.3).

Curriculum Compilation
At second year level students continue with Heritage Studies as their major subject; Students also proceed with the BA language subject selected as minor subject in the first year. The normal second year level curriculum of a student registered in the BA (Tourism - Heritage) degree programme will therefore consist of nine (9) Courses (144 credits), compiled as follows:

Subject	Courses	Credits
Heritage Studies at second year level as a major subject	5	80
Selected BA language subject at second year level as minor subject	3	48
Tourism Business Internship	1	08
Total	9	136

Curriculum

All students register for the four following Courses			
Semester	Code	Course Title	Prerequisite
1	GHT 3601	Physical Geography of Namibia (half course)	HGHE 3581
1	GHE 3661	Economic Geography (half course)	HGHE 3582
2	GHE 3642	Biogeography (half course)	
2	GHE 3682	Social Geography (half course)	
1	VVC 3611	Visual Culture and Concepts in Africa	-
2	PAT 3632	Ethnomusicology: Musical Art in Namibia	-
2	HGE 3612	Namibian 19/20 Century	-
1	GTI 3699	Tourism Business Internship (All students register for this course)	-
BA Language Subject	Students add the three (3) second year level Courses of the selected BA language subject as minor subject, in line with the relevant subject regulations.		

I.8.7.12. Third Year Level

Admission Requirements

THE FACULTY'S STUDENT REGISTRATION AND ACADEMIC ADVANCEMENT RULES APPLY (CF. C.4.3).

Curriculum Compilation

At third year level students continue Heritage Studies as their major subject. Students also proceed with the BA language subject selected as a minor subject in the first year. The normal third year level curriculum of a student registered in the BA (Tourism - Heritage) degree programme will therefore consist of nine (9) Courses (136 credits), compiled as follows:

Subject	Courses	Credits
Heritage Studies at third year level as a major subject	6	96
Selected BA language subject at third year level as minor subject	2	32
Tourismm Business Internship	1	08
Total	9	136

Curriculum

Students must choose either Group A or Group B below and take all the courses in the chosen group:			
GROUP A			
Semester	Code	Course Title	Prerequisite/ co-requisite
1	GHE 3711	Environmental Studies	-
1	GHE 3731	General Methods and Techniques	-
2	GHE 3752	Regional Geography	-
1 & 2	GES 3799	Excursion*	
1	HGE 3772	World History	
2	SOG 3772	Sociology of Namibian Society	
1	GTI 3799	Tourism Business Internship (All students register for this course)	
GROUP B			
1	GHE 3711	Environmental Studies	
1	GIS 3711	Geographic Analysis and Techniques	HGIS 3711 Placement test
2	GIS 3732	Geographical Information Systems	
1 & 2	GES 3799	Excursion*	-
1	GE 3772	World History	-
2	SOG 3772	Sociology of Namibian Society	-
1	GTI 3799	Tourism Business Internship (All students register for this course)	-
Students add the two (2) third year level Courses of the selected BA language subject as minor subject, in line with the relevant subject regulations.			

**** Although carrying a course code, an excursion is not weighed as a course, but is compulsory for the completion of Heritage Studies at NQF Level 7.***

Note: Throughout the academic year, the above courses require three (3) hours practical work per week: Practical 3.

I.8.7.13 Fourth Year Level

Admission Requirements

1. A student admitted to the fourth year level (cf. C.4.3.3.1) may register for the seven (7) (128 credits) fourth year courses plus one (1) outstanding course on first, second or third year level.

The exception to this change of regulation will be where courses are prerequisites for other course taken at 4th year level in which case a student will not be allowed to take the courses she/he has not yet passed.

2. Note the prerequisite below.

Curriculum Compilation

At fourth year level students continue with Heritage Studies as their first major subject and Geography and Environmental Studies as their second major subject. The BA language subject selected as minor subject is discontinued after its required Courses at first to third year level have been passed. The normal fourth year level curriculum of a student registered in the BA (Tourism) degree programme will therefore consist of eight (8) Courses (128 credits), compiled as follows:

Subject	Courses	Credits
Heritage Studies at fourth year level as a major subject	8	128
Total	8	128

Curriculum

All students take the following course:			
Semester	Code	Course Title	Prerequisite/Co-requisite
1 & 2	GHT 3800	Tourism Studies	
1 & 2	GSP 3800	Environmental Management and Governance	HGHE3711
1 & 2	GHF 3899	Field Work	
1 & 2	HGE 3820	Public History/Museum and Heritage Studies	
1 & 2	VVC 3840	Tourism and Visual Culture in Namibia	
1 & 2	GHG 3810	Research Project in Heritage Studies	
1 & 2	LGT 3800	Intercultural Communication	
Students furthermore choose either Group A or Group B below and take all the courses in the chosen group:			
GROUP A			
Semester	Code	Course Title	Prerequisite
1 & 2	GHE 3820	Themes in Advanced Geography and Environmental Studies	
GROUP B			
1	GHR 3801	Remote Sensing (half-course)	HGIS 3732
2	GHR 3822	Applied Spatial Analysis (half-course)	(HGHR 3801)

I.8.7.14 Course Descriptors

FIRST YEAR LEVEL

GHE 3581 Fundamentals of Physical Geography

Proposed NQF Level: 5 Credits: 12 Contact Hours: 3 hours/week over 14 weeks = 42 contact hours

Content: Students acquaint themselves with the essential foundations of Physical Geography, including common links to auxiliary disciplines and fields of study. The course presents structures, functions, processes and distributional patterns inherent in phenomena of "natural" environments, relating to climate, geomorphology, hydrology, soils and vegetation. The content focuses on the interrelationship of geo-ecosystems, including the human factor. With particular reference to Namibian conditions, the course offers fundamental applications of concepts inherent in the functioning of the atmo-, litho-, hydro- and biosphere.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHE 3582 Fundamentals of Human Geography

Proposed NQF Level: 5 Credits: 12 Contact Hours: 3 hours/week over 14 weeks = 42 contact hours

Content: Students acquaint themselves with foundations and concepts of Human Geography, including the subject's links to auxiliary disciplines. The course presents structures, functions, processes and distributional patterns inherent in phenomena of human environments. The content focuses on demographic features of population, rural and urban settlements and economic activities including tourism, land-use and infrastructure, regional diversity / similarity as well as politico-geographical perspectives relating to spatial development. Local to international references cover Namibia, the African continent and selected regions of the world. The course structure implies practical exercises/assignments aiming at fostering application of knowledge, reflective thinking and practical skills.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

HGE 3581 African Civilisations

Proposed NQF Level: 5 Credits: 12 Contact Hours: 3 hours/week over 14 weeks = 42 contact hours

Content: This course serves to introduce the student to African history. Important and very old African civilisations will be explored, namely Ethiopia, the empire of Mali, the Ancient Kingdom of Ghana and Great Zimbabwe. Students' attention will be directed to important aspects of general African history: archaeology, ancient cultures, art, material culture, trade, society, gender, literature, religion and politics. At the same time students will be introduced to the tools of the trade and methodological and theoretical issues will be dealt with by way of introduction. The module explores the issues through lectures. Students are expected to attend all lectures, to participate actively in the teaching process and to engage with the prescribed readings. Students are assessed with tests (60%) during the semester and a final examination (40%).

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHT 3581 Fundamentals of Tourism Management

Proposed NQF Level: 5 Credits: 12 Contact Hours: 3 hours/week over 14 weeks = 42 contact hours

Content:The course familiarises students with the principles of business management, with special reference to tourism. Different types of tourism businesses and the environment in which they operate will be presented, and their functional areas of management i.e. finance, marketing, operations and human resources will be introduced. The course further elaborates on the elements of management such as planning, organizing, coordinating, commanding and controlling and their application in tourism

management. The course builds an understanding on the concept of managing change in organizations and the importance of innovation.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHT 3582 Customer Relations in Tourism Management

Proposed NQF Level: 5 Credits: 12 Contact Hours: 3 hours/week over 14 weeks = 42 contact hours
Content: This course provides students with knowledge and skills necessary in managing customer relationships. Being a service industry, it addresses the current need for excellence in customer service relations within the Namibian tourism industry. The content covers the crucial strategies that may be implemented to create a customer-centred culture within an organisation. It exposes students to the various methods managers of travel and tourism take advantage of in order to motivate employees towards providing excellence to their customers. The understanding, that successful customer relations in tourism are based upon a combination of technical expertise, the ability to manage both information and people, and efficient, productive communication will be emphasized.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

LAC 3582 Language and Culture

Proposed NQF Level: 5 Credits:12 Contact Hours: 3 hours/week over 14 weeks = 42 contact hours
Content: This course is intended to let students reflect on issues of identity, self-perception and the inseparability of language and culture. The essence of the course rests on dialogue between lecturers and students of the same and of different cultures in class so as to deepen one's perception of one's own culture and to gain respect through understanding for the other cultures represented. Particular domains of the language and culture that tend to become obliterated should be discussed and contrasted, e.g. naming practises, kinship systems, figurative language, etiquette. Students are also encouraged to accept dialects as enrichment of the language.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

SECOND YEAR LEVEL

GHT 3601 Physical Geography of Namibia (half-course)

Proposed NQF Level: 6 Credits: 8 Contact Hours: 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: None
Content: The course investigates components, patterns, processes and functions relating to phenomena of climatology such as air temperature, atmospheric moisture and precipitation, atmospheric pressure motion and circulation. In geomorphology, the content focuses on processes such as weathering and mass wasting; and the creation of structural terrestrial, marine and aeolic landforms. Landscapes from Namibia and southern Africa exemplify the relevant types of landforms.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3661 Economic Geography (half course)

Proposed NQF Level: 6 Credits: 8 Contact Hours: 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: HGHE 3582
Content: Departing from the first year of fundamental topics in human geography, the course aims to broaden geographic knowledge, illustrate models, concepts and systems observed in economic geography and spatial patterns of economic land-use, distribution and development. The courses' objective means to enhance the comprehension of economic activity and its impact on local environments, national growth and global relationship.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3642 Biogeography (half-course)

Proposed NQF Level: 6 Credits: 8 Contact Hours: 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: None
Content: This course introduces students to the components, functions, processes, patterns and phenomena of Biogeography. Biogeography includes a broad range of topics including evolution, ecology, history of biogeography, biogeographical system, population ecology, distribution of single species and communities, dispersal and extinction, continental biogeography, conservation biogeography and biodiversity.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3682 Social Geography (half-course)

Proposed NQF Level: 6 Credits: 8 Contact Hours: 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: None
Content: This course offers students concepts and approaches to essential thinking in Social Geography, broadening students' understanding of the interplay between society and space, including the interface experienced between society, crime and space. The content encompasses topics such as types of society and their structures; indicators defining disparities in livelihood; gender equality and social justice; as well as conditions of access to health and socio-economic development. Lectures present key concepts assumed to be "organising principles in societies", complemented by "culture-specific" perceptions pertaining to groups / classes of society and their regional distribution with an emphasis on Namibia.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

VVC 3611 Visual Culture and Concepts in Africa

Proposed NQF Level: 6 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: The study of literature on the Namibian heritage of visual culture such as rock art and customary art will be complemented by field excursions. The second component analyses local examples of the role of visual culture in the formation and affirmation of identity in Namibia. Cross-reference will be made to selected manifestations in southern Africa.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

PAT 3632 Ethnomusicology: Musical Art in Namibia

Proposed NQF Level: 6 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: The course introduces students to the exploration of music and dance in Namibia, with the focus on traditional musical functions, instruments and performance, as well as contemporary Namibian musical arts. In this course the students will also learn about arts promotion and management within the eco-tourism industry. The course will furthermore prepare students to develop an awareness of the role and functions of musical arts in society, community, families and the individual. The students will also learn how to establish an arts centre at a tourism destination.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

HGE 3612 Namibia 19/20 Century

Proposed NQF Level: 6 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: Focus on early Namibian history: communities, languages, material cultures, arts and crafts; trade, politics, intergroup-relations, migrations; proto-colonial developments: the Oorlam migrations, traders, hunters, missionaries; Conflict & cooperation: Oorlam, Nama, Herero & Damara; interaction of European traders and missionaries and Oorlam/Nama and Herero peoples. Methodologies: oral history, critical reading of available historical sources, writing. Essay writing, written assignments & working with various sources. These skills & competencies are essential for the fourth year Research Essay & are part of the ongoing programme aiming to implement research methodological skills.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

THIRD YEAR LEVEL

GHE 3711 Environmental Studies

Proposed NQF Level: 7 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: This course allows students to comprehend the paramount interaction of humans and their environment, the reasons for and consequences of this interrelationship and in many instances the ameliorating scenarios society can implement. Students should achieve this objective by integrating disciplines through the application of knowledge and research with oral and written presentations.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHE 3731 General Methods and Techniques in Geography

Proposed NQF Level: 7 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: The course offers application-oriented insights into scientific methods and techniques, comprising the formulation of hypotheses and assumptions; collection and compilation of data; research design and selection of research methods. Examples from field surveys and the formulation of research findings aim at strengthening course and project work capabilities.
With view to secondary school course work and post-graduate studies the content exposes students to map production and basic geodesy. The course apply the scientific knowledge for the formulation of hypotheses and assumptions, collection and analysis of data, selection of research methods and
geographic information tools to display spatial data. Map interpretation and aerial photography analysis complements essential skills in geographic analysis techniques, needed for course work and research. Introductory hands-on lecturing builds necessary experiences in GIS for special application at senior secondary school level, seeking to ensure that all participants share a working knowledge of spreadsheet capabilities.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GIS 3711 Geographic Analysis and Techniques

Proposed NQF Level: 7 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: The course offers application-oriented insights into scientific methods and techniques, comprising the formulation of hypotheses and assumptions; collection and compilation of data; research design and management; field survey and reconnaissance; as well as the formulation of findings. The course apply scientific knowledge to the selection of computer-assisted spatio- analytical tools supported by GIS and Statistics.Relevant computer-assisted GIS software supports practical components of the course work, seeking to ensure that all participants share a working knowledge of spreadsheet capabilities.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GIS 3732 Geographical Information Systems

Proposed NQF Level: 7 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: The course introduces students to computer-assisted spatial data processing; development, implementation and functions of geographic information systems; data models and structures; as well as analytical procedures. The content focuses on foundations of mapping, database management and information science, including concepts that are essential to any GIS package. Project work based on the application of GIS to a variety of environmental problem formations complement skill-orientated exercises, offered in the Laboratory for Spatial Analysis, DGHES. Hands-on experiences provide students with advanced skills. They should enable students to master software packages such as ArcView, ArcInfo and IDRISI/ILWIS in order to facilitate the creating of maps of geographical locations and their attributes; the performing of spatial analyses using spatial and attributed data; and the display of results in the form of maps and tables.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GES 3799 Excursion

Excursions encourage students to apply methods and techniques required for observing, analysing, assessing and comprehending the particularities of landscapes on site. They offer crucial experiences in team work and prepare for course work design and research.

HGE 3772 World History

Proposed NQF Level: 7 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: This Courses centres on the colonial period with a focus on interaction between Africans and Europeans; the role of indigenous populations and rulers is explored, with special attention to resistance and collaboration; the aims and impact of German and South African colonialism, westernisation, the liberation struggle and the dynamics of Namibian nationalism are key themes; of special concern is methodology: the utilisation of archives and familiarisation with key secondary texts on twentieth century Namibia. The research methodology section (two weeks) aims to impart essay-writing and research skills. This course serves as a foundational course for the fourth-year level research project.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

SOG 3772 Sociology of Namibian Society

Proposed NQF Level: 7 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: The course aims to provide future teachers with a sound foundation with which they can engage the international relations syllabus covered in the Senior Secondary Phase of the School Curriculum. Major topics include: World War I & II, the rise of Fascism, the origins of the Cold War, Independence Movements and the end of colonial rule, the United Nations and growing international cooperation and the collapse of Soviet Communism & rise of democracy. Special attention is paid to the causes underlying these transformations & how it has changed the course of 20th century world history. The underlying significance of events will be explored to convey meaning about events & developments that have fundamentally changed the relationship between the West and the Rest of the World, resulting in the collapse of formal colonialism and unprecedented challenges to western imperialism. Students will be exposed to various secondary sources & learn how to utilize oral, primary & secondary written sources and how public history (photographs, monuments, artifacts, music) can be used to broaden understanding and to imaginatively reconstruct events. Special attention will be paid to the role of gender, war and disease in shaping the course of events & developments.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

FOURTH YEAR LEVEL

GHT 3800 Tourism Studies

Proposed NQF Level: 8 Credits: 16 Contact Hours: 2 hours/week over 28 weeks = 56 contact hours
Prerequisite: Admission to the fourth year level
Content: Students acquaint themselves with the generation and application of complex data sets for tourism planning and development with the assistance of principles, theories and trans-disciplinary methods applied to tourism studies. The course responds to the growing significance of and need for tourism research in Namibia, taking into consideration the growth of the tourism industry and the country's subscription to sustainable development, which require ethical behaviour, informed consumption of natural resources and sharing distribution of wealth.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GSP 3800 Environmental Management and Governance

Proposed NQF Level: 8 Credits: 16 Contact Hours: 2 hours/week over 28 weeks = 56 contact hours
Prerequisite: Admission to the fourth year level
Content: This course advances students' comprehension of the interdependent functioning whole of the geo-system, biological and human system (geo-ecosystem) through a strong focus on environmental resources and selected environmental problem formations. The content demonstrates the need for conservation and environmental management. Discussions examine academic perspectives and build intellectual skills required in evaluation procedures such as Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA). Practice-orientated assignments apply principles of Integrated Environmental Management (IEM). The course fosters the internalisation of environmental obligations, environmental auditing and environmental ethics needed for sustainable societies.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHR 3822 Applied Spatial Analysis (half-course)

Proposed NQF Level: 8 Credits: 8 Contact Hours: 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: Admission to the fourth year level and HGHR 3801 Remote Sensing
Content: This course allows students to deepen their previously acquired skills in geographic analysis and techniques (HGIS 3711), GIS (HGIS 3732) and Remote Sensing (HGHR 3801) by applying them in a wide range of areas such as environmental impact assessment, water resources management, environmental modelling, and terrain analysis. It is designed to develop students' applied vocational and professional skills relevant to work or research. The content is essentially pegged to the course HGHE 3810: Research Project in Geography and Environmental Studies, in which geostatistic, GIS and / or Remote Sensing could be employed as a major tool.
Assessment: Continuous assessment 100% (Project and poster presentation)

GHR 3801 Remote Sensing (half-course)

Proposed NQF Level: 8 Credits: 8 Contact Hours: 2 hours/week over 14 weeks = 28 contact hours

Prerequisite: Admission to the fourth year level

Content: This course focuses on the physical principles of remote sensing data acquisition and handling, optical and digital image processing techniques, and environmental and scientific applications of remote sensing data from local to global scales.

Specifically, the course deals with the following topics:

1. physical principles of the visible, infrared and microwave section of the electromagnetic spectrum;
2. remote sensing platforms and sensors;
3. data acquisition, storage and processing;
4. image processing and analysis;
5. remote sensing applications in geosciences.

The course is delivered through a mixture of lectures, tutorials and practicals using remotely sensed data, and practice in digital image processing techniques to provide relevant information for addressing geoscientific issues at a range of temporal and spatial scales.

Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3820 Themes in Advanced Geography and Environmental Studies

Proposed NQF Level: 8 Credits: 16 Contact Hours: 2 hours/week over 14 weeks = 56 contact hours

Prerequisite: Admission to the fourth year level

Content: The content focuses on themes in Physical and Human Geography as well as Environmental Studies that were recently or are currently researched or published by members of the Section, including professional members working in fields of applied geography, environmental management and/or tourism. This seminar-style course requires discussion and research assignments. Students choose their research assignments from specific topics announced during the first week of lecturing in the first semester of the relevant academic year.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

HGE 3820 Public History/Museum and Heritage Studies

Proposed NQF Level: 8 Credits: 16 Contact Hours: 2 hours/week over 28 weeks = 56 contact hours

Prerequisite: Admission to the fourth year level

Content: This course explores the origins of museums, debates about ethnographic representation and the repatriation of cultural artefacts, practical analysis of museum displays and their meanings. Consideration is given to the relationship between tourism and the heritage industry and analysis centres on discussions of the concept of 'the tourist gaze' and forms of representation in the marketing of culture; the role and significance of monuments, commemorations and memorials are investigated. Debates over what is remembered, dissonant heritage and dark history render this course a critical tool with which to investigate the ways and means through which the past is structured and remembered.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

VVC 3840 Tourism and Visual Culture in Namibia

Proposed NQF Level: 8 Credits: 16 Contact Hours: 2 hours/week over 28 weeks = 56 contact hours

Prerequisite: Admission to the fourth year level

Content: This analysis of the impact of tourism on visual culture in Namibia aims at developing coherent and critical understanding of some of the main principles and approaches of discourse on visual culture in the realm of tourism. Students will engage in critique of selected readings on areas of tourism such as the media, cultural tours and visual arts projects.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHG 3810 Research Project in Heritage Studies

Proposed NQF Level: 8 Credits: 32 Contact Hours: 2 hours/week over 28 weeks = 56 contact hours

Prerequisite: Admission to the fourth year level

Content: This course represents a research component for which the student will select a research topic from one of the Courses the Section: History offers at fourth year level (NQF Level 8), in consultation with the Department of Geography, History and Environmental Studies. Students will initially attend lectures in research methodology. After selection of a topic, each student will prepare and present a structured research proposal to her/his supervisor by the required deadline. Following approval of the research proposal, the student will conduct her/his research and write a research project of between 10 000 and 15 000 words according to Departmental guidelines and with the guidance of her/his supervisor. Students will be required to attend regular Departmental research seminars during the year where they will report on the progress of their research.

Assessment: Continuous assessment 100% (research project)

LGT 3800 Intercultural Communication

Proposed NQF Level: 8 Credits: 16 Contact Hours: 2 hours/week over 28 weeks = 56 contact hours

Prerequisite: Admission to the fourth year level

Content: The theory of intercultural communication in a multicultural and multilingual society, with special reference to the Namibian society.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

I.9 BACHELOR OF ARTS IN TOURISM: MANAGEMENT STUDIES (HONOURS) (13BATM)

I.9.1 BA (Tourism: Management Studies) (Hons) (13BTMS) (for internal use only)

I.9.2 Introduction

In the light of the tourism potential ascribed to Namibia, the qualification of the four year BA degree in Tourism Management Studies (Honours) programme provides an academic skills-based education for students who intend to enter careers in the tourism-management field in areas such as promotion, planning, management or policy-making in tourism-management, as well as research and publishing relating to tourism-management and culture. The programme subscribes to trans-disciplinary learning paradigms nurtured at UNAM. Its purpose is to establish confidence, capacity and ability to exercise professional judgment pertaining to decision-making, tasks and responsibilities inherent in the private and public sector of tourism- heritage and culture to the benefit of society. The BA degree in tourism- heritage inter alia responds to employment opportunities relating to the sector of tourism-heritage focusing on branding "culture" in addition to "nature" and "landscapes". The BA degree in Tourism- Managment Studies furthers students' knowledge and skills in the socio-cultural domain, including language, heritage, music, art and history of the Namibian society. Students no longer do communication, so a foreign language course (instead of communication) and presentation training offered in the Faculty constitute an indispensable complement to the programme.

Programme Convenor: M.E. Kimaro (Tel. 206 3716 – E-mail: mekimaro@unam.na)

I.9.3 Exit Objectives

Upon completion of this programme students will be able to

apply their skills-based knowledge in professional domains of the public and private sector of the tourism industry analyse and evaluate problem formations evolving from institutional, commercial, socio-cultural and environmental tourism activities design professional solutions demonstrate confidence, capacity and ability in professional judgment and decision-making employ professional ethics in dealing with tasks and responsibilities inherent in the private and public sector of the tourism industry to the benefit of society

I.9.4 Admission

I.9.4.1 Refer to C.1 Admission under C. Regulations Pertaining to Undergraduate Studies in the Faculty in this yearbook.

I.9.4.1.2

Refer to the admission requirements of the relevant BA language subject that represents the minor subject in this programme (in the BA Subject Regulations and Course Descriptors section of this yearbook).

I.9.5 Curriculum Compilation

I.9.5.1 Overall Structure

The BA (Tourism) degree is a double-major qualification consisting of two (2) major subjects, i.e. Tourism Management Studies or Heritage Studies and Geography and Environmental Studies taken up to fourth year level, one (1) minor subject (a language subject selected from the BA language subjects in E.1.3.2.1) taken up to third year level, two (2) programme core Courses taken at first year level only, plus the University Core Curriculum Courses at first year level.

I.9.5.2

The BA (Tourism) degree programme consists of a total of 35 Courses (528 credits) at the various year levels in the various subjects as outlined above, all of which a student must pass in order to graduate (cf. C.4.2.1).

I.9.5.3

The overall structure of the BA (Tourism) degree programme can be schematically represented as follows:

Fourth			3 courses	4 courses	
Third		2 courses	3 courses	2 courses	0.5 Course
Second		3 courses	2 courses	3 courses	0.5 Course
First	3 courses*	2 courses	2 courses	4 courses	
Year Level	UNAM Core Curriculum (48 credits)	Language Subject Minor Subject (104 credits)	Geography & Environ. Studies Major Subject 1 (152 credits)	Tourism Management/ Heritage Studies Major Subject 2 (208 credits)	Tourism Business Internship (16 credits)

**** The University Core Curriculum consists of two (2) Courses and two (2) half-Courses (cf. C.4.3.1).***

I.9.5.4

To be awarded the BA (Tourism) degree, a student must pass all 35 Courses (528 credits) within the curriculum structure as stipulated above.

I.9.5.6

Courses/credits are not horizontally, vertically or laterally transferable.

I.9.5.7 First Year Level

Curriculum Compilation

At first year level students register for the University Core Curriculum courses and the required six (6) Tourism Management Studies courses. Furthermore, students select one (1) language from the available BA language offerings as minor subject and register for the two (2) required first year level courses in the relevant language, in line with the relevant subject regulations. The normal first year level curriculum of a student registered in the BA (Tourism Management Studies) degree programme will therefore consist of eleven (11) courses (144 credits), compiled as follows:

Subject	Courses	Credits
University Core Curriculum (cf. C.4.3.1)	3	48
Tourism Management Studies at first year level	6	72
Selected BA language discipline at first year level**	2	24
Total	11	144

***** Students select the BA language subject in line with the relevant subject regulations.***

Curriculum

Students register for all six (6) Courses below:			
	Semester	Code	Course Title
COURSES	1	GHE 3581	Fundamentals of Physical Geography
	2	GHE 3582	Fundamentals of Human Geography
	1	HGE 3581	African Civilisations
	2	LAC 3582	Language and Culture
	1	GHT 3581	Fundamentals of Tourism Management
	2	GHT 3582	Customer Relations in Tourism
BA Language Subject	Students select one (1) of the language subjects below and register for the corresponding two (2) first year level courses as indicated, in line with the relevant subject regulations. This subject will be taken up to third year level.		

French as Applied and Business Language#	1	LFB 3581	Foundations of French
	2	LFB 3582	French for Beginners
German as Applied and Business Language#	1	LGB 3581	Foundations of German
	2	LGB 3582	German for Beginners
Portuguese as Applied and Business Language#	1	LPB 3581	Foundations of Portuguese
	2	LPB 3582	Portuguese for Beginners
Spanish as Applied and Business Language#	1	LSB 3581	Foundations of Spanish
	2	LSB 3582	Spanish for Beginners

**** Throughout the academic year, the above courses require three (3) hours practical work per week: Practical 1.***
 # Prerequisite: Students should have no prior knowledge of the language that they select. Students who are competent in any of these languages may not take them.

I.9.5.8 Second Year Level

Admission Requirements

The Faculty's Student Registration and Academic Advancement Rules apply (cf. C.4.3).

Curriculum Compilation

At second year level students continue with Tourism Management Studies as a major subject; Students also proceed with the BA language subject selected as minor subject in the first year. The normal second year level curriculum of a student registered in the BA (Tourism Management Studies) degree programme will therefore consist of nine (9) Courses (144 credits), compiled as follows:

Subject	Courses	Credits
Tourism Management Studies at second year level as a major subject	5	80
Selected BA language subject at second year level as minor subject	3	48
Tourism Business Internship	1	08
Total	9	136

Curriculum

All students register for the four following Courses			
Semester	Code	Course Title	Prerequisite
1	GHT 3601	Physical Geography of Namibia (half course)	HGHE 3581
1	GHE 3661	Economic Geography (half course)	HGHE 3582
2	GHE 3642	Biogeography (half course)	
2	GHE 3682	Social Geography (half course)	
1	PSI 3631	Organisational/Personnel Psychology	-
1	GHT 3631	Tourism Accounting	-
2	GHT3652	Operations Management in Tourism	-
1	GTI 3699	Tourism Business Internship (All students register for this course)	-
BA Languag e Subject	Students add the three (3) second year level Courses of the selected BA language subject as minor subject, in line with the relevant subject regulations.		

I.9.5.9 Third Year Level

Admission Requirements

The Faculty's Student Registration and Academic Advancement Rules apply (cf. C.4.3).

Curriculum Compilation

At third year level students continue Tourism ManagementStudies as a major subject. Students also proceed with the BA language subject selected as a minor subject in the first year. The normal third year level curriculum of a student registered in the BA (Tourism Management Studies) degree programme will therefore consist of nine (9) Courses (136 credits), compiled as follows:

Subject	Courses	Credits
Tourism Management Studies at third year level as a major subject	6	96
Selected BA language subject at third year level as minor subject	2	32
Tourismm Business Internship	1	08
Total	9	136

Curriculum

Students must choose either Group A or Group B below and take all the courses in the chosen group:			
GROUP A			
Semester	Code	Course Title	Prerequisite/ co-requisite
1	GHE 3711	Environmental Studies	-
1	GHE 3731	General Methods and Techniques	-
2	GHE 3752	Regional Geography	-
1 & 2	GES 3799	Excursion*	
1	GHT 3711	Tourism Management	
2	GHT 3732	Tourism Entrepreneurship	
1	GTI 3799	Tourism Business Internship (All students register for this course)	
GROUP B			
1	GHE 3711	Environmental Studies	
1	GIS 3711	Geographic Analysis and Techniques	HGIS 3711 Placement test
2	GIS 3732	Geographical Information Systems	
1 & 2	GES 3799	Excursion*	-
1	GHT 3711	Tourism Management	-
2	GHT 3732	Tourism Entrepreneurship	-
1	GTI 3799	Tourism Business Internship (All students register for this course)	-
Students add the two (2) third year level Courses of the selected BA language subject as minor subject, in line with the relevant subject regulations.			

**** Although carrying a course code, an excursion is not weighed as a course, but is compulsory for the completion of T ourism Managemeng at NQF Level 7.***

Note: Throughout the academic year, the above courses require three (3) hours practical work per week: Practical 3.

I.9.5.10 Fourth Year Level

Admission Requirements

1. A student admitted to the fourth year level (cf. C.4.3.3.1) may register for the eight (8) (128 credits) fourth year courses plus one (1) outstanding course on first, second or third year level.
The exception to this change of regulation will be where courses are prerequisites for other course taken at 4th year level in which case a student will not be allowed to take the courses she/he has not yet passed.
2. Note the prerequisite below.

Curriculum Compilation

At fourth year level students continue with their major subject. The BA language subject selected as minor subject is discontinued after its required Courses at first to third year level have been passed. The normal fourth year level curriculum of a student registered in the BA (Tourism Management Studies) degree programme will therefore consist of eight (8) Courses (128 credits), compiled as follows:

Subject	Courses	Credits
Tourism Management Studies at fourth year level as a major subject	8	128
Total	8	128

Curriculum

All students take the following course:			
Semester	Code	Course Title	Prerequisite/Co-requisite
1 & 2	GHT 3810	Research Project in Tourism Management Studies	
1 & 2	GHT 3800	Tourism Studies	
1 & 2	GSP 3800	Environmental Management and Governance	HGHE3711
1 & 2	GHF 3899	Field Work	
1 & 2	GHT 3820	Tourism Planning and Development	
1 & 2	GHT 3840	Tourism Marketing	
1 & 2	SOG 3820	Rural Sociology	
Students furthermore choose either Group A or Group B below and take all the courses in the chosen group:			
GROUP A			
Semester	Code	Course Title	Prerequisite/Co-requisite
1 & 2	GHE 3800	Political Geography	
GROUP B			
1	GHR 3801	Remote Sensing (half-course)	HGIS 3732
2	GHR 3822	Applied Spatial Analysis (half-course)	(HGHR 3801)

I.9.5.11 Course Descriptors

First Year Level

GHE 3581 Fundamentals of Physical Geography

Proposed NQF Level: 5 Credits: 12 Contact Hours: 3 hours/week over 14 weeks = 42 contact hours
Content: Students acquaint themselves with the essential foundations of Physical Geography, including common links to auxiliary disciplines and fields of study. The course presents structures, functions, processes and distributional patterns inherent in phenomena of "natural" environments, relating to climate, geomorphology, hydrology, soils and vegetation. The content focuses on the interrelationship of geo-ecosystems, including the human factor. With particular reference to Namibian conditions, the course offers fundamental applications of concepts inherent in the functioning of the atmo-, litho-, hydro- and biosphere.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHE 3582 Fundamentals of Human Geography

Proposed NQF Level: 5 Credits: 12 Contact Hours: 3 hours/week over 14 weeks = 42 contact hours
Content: Students acquaint themselves with foundations and concepts of Human Geography, including the subject's links to auxiliary disciplines. The course presents structures, functions, processes and distributional patterns inherent in phenomena of human environments. The content focuses on demographic features of population, rural and urban settlements and economic activities including tourism, land-use and infrastructure, regional diversity / similarity as well as politico-geographical perspectives relating to spatial development. Local to international references cover Namibia, the African continent and selected regions of the world. The course structure implies practical exercises/assignments aiming at fostering application of knowledge, reflective thinking and practical skills.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

HGE 3581 African Civilisations

Proposed NQF Level: 5 Credits: 12 Contact Hours: 3 hours/week over 14 weeks = 42 contact hours
Content: This course serves to introduce the student to African history. Important and very old African civilisations will be explored, namely Ethiopia, the empire of Mali, the Ancient Kingdom of Ghana and Great Zimbabwe. Students' attention will be directed to important aspects of general African history: archaeology, ancient cultures, art, material culture, trade, society, gender, literature, religion and politics. At the same time students will be introduced to the tools of the trade and methodological and theoretical issues will be dealt with by way of introduction. The module explores the issues through lectures. Students are expected to attend all lectures, to participate actively in the teaching process and to engage with the prescribed readings. Students are assessed with tests (60%) during the semester and a final examination (40%).
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHT 3581 Fundamentals of Tourism Management

Proposed NQF Level: 5 Credits: 12 Contact Hours: 3 hours/week over 14 weeks = 42 contact hours

Content:The course familiarises students with the principles of business management, with special reference to tourism. Different types of tourism businesses and the environment in which they operate will be presented, and their functional areas of management i.e. finance, marketing, operations and human resources will be introduced. The course further elaborates on the elements of management such as planning, organizing, coordinating, commanding and controlling and their application in tourism management. The course builds an understanding on the concept of managing change in organizations and the importance of innovation.

Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHT 3582 Customer Relations in Tourism Management

Proposed NQF Level: 5 Credits: 12 Contact Hours: 3 hours/week over 14 weeks = 42 contact hours

Content: This course provides students with knowledge and skills necessary in managing customer relationships. Being a service industry, it addresses the current need for excellence in customer service relations within the Namibian tourism industry. The content covers the crucial strategies that may be implemented to create a customer-centred culture within an organisation. It exposes students to the various methods managers of travel and tourism take advantage of in order to motivate employees towards providing excellence to their customers. The understanding, that successful customer relations in tourism are based upon a combination of technical expertise, the ability to manage both information and people, and efficient, productive communication will be emphasized.

Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

Second Year Level

GHT 3601 Physical Geography of Namibia (half-course)

Proposed NQF Level: 6 Credits: 8 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours

Prerequisite: None

Content: The course investigates components, patterns, processes and functions relating to phenomena of climatology such as air temperature, atmospheric moisture and precipitation, atmospheric pressure motion and circulation. In geomorphology, the content focuses on processes such as weathering and mass wasting; and the creation of structural terrestrial, marine and aeolic landforms. Landscapes from Namibia and southern Africa exemplify the relevant types of landforms.

Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3661 Economic Geography (half-course)

Proposed NQF Level: 6 Credits: 8 Contact Hours: 2 hours/week over 14 weeks = 28 contact hours

Prerequisite: HGHE 3582

Content: Departing from the first year of fundamental topics in human geography, the course aims to broaden geographic knowledge, illustrate models, concepts and systems observed in economic geography and spatial patterns of economic land-use, distribution and development. The courses' objective means to enhance the comprehension of economic activity and its impact on local environments, national growth and global relationship.

Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3642 Biogeography (half-course)

Proposed NQF Level: 6 Credits: 8 Contact Hours: 2 hours/week over 14 weeks = 28 contact hours

Prerequisite: None

Content: This course introduces students to the components, functions, processes, patterns and phenomena of Biogeography. Biogeography includes a broad range of topics including evolution, ecology, history of biogeography, biogeographical system, population ecology, distribution of single species and communities, dispersal and extinction, continental biogeography, conservation biogeography and biodiversity.

Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GHE 3682 Social Geography (half-course)

Proposed NQF Level: 6 Credits: 8 Contact Hours: 2 hours/week over 14 weeks = 28 contact hours

Prerequisite: None

Content: This course offers students concepts and approaches to essential thinking in Social Geography, broadening students' understanding of the interplay between society and space, including the interface experienced between society, crime and space. The content encompasses topics such as types of society and their structures; indicators defining disparities in livelihood; gender equality and social justice; as well as conditions of access to health and socio-economic development. Lectures present key concepts assumed to be "organising principles in societies", complemented by "culture-specific" perceptions pertaining to groups / classes of society and their regional distribution with an emphasis on Namibia.

Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

PSI 3631 Organisational/Personnel Psychology

Proposed NQF Level: 6 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours

Prerequisite: None

Content: Students will gain a basic understanding of the approaches in organisational and personnel psychology. Specific topics will include leadership theories, interactive behaviour and conflicts, communication, decision-making and processes of human resources development, such as job analysis, job description, recruitment and selection.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHT 3631 Tourism Accounting

The course introduces students to the foundations in accounting for tourism entities; the accounting equation and double-entry system; the ledger and journal books, bank reconciliations; financial statements of tourism entities and budgets and budgetary control.

GHT 3652 Operations Management in Tourism

The course familiarizes students with the management of operations within the travel and tourism industry. It identifies the different operations managed within the tourism industry sectors. It addresses the issues of design and human relations of the working organisation that lead to efficient production methods. The content emphasizes the importance of understanding operations and processes while considering factors such as,quality, speed of delivery, employee empowerment and flexibility of businesses. The course examines the relationship between information technology and tourism, from both a tourists and organisations' perspective. Students will critically evaluate current and emerging developments in information technology and their impact on tourists and suppliers.

THIRD YEAR LEVEL

GHE 3711 Environmental Studies

Proposed NQF Level: 7 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours

Prerequisite: None

Content: This course allows students to comprehend the paramount interaction of humans and their environment, the reasons for and consequences of this interrelationship and in many instances the ameliorating scenarios society can implement. Students should achieve this objective by integrating disciplines through the application of knowledge and research with oral and written presentations.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GES 3799 Excursion

Excursions encourage students to apply methods and techniques required for observing, analysing, assessing and comprehending the particularities of landscapes on site. They offer crucial experiences in team work and prepare for course work design and research.

GHE 3731 General Methods and Techniques in Geography

Proposed NQF Level: 7 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours

Prerequisite: None

Content: The course offers application-oriented insights into scientific methods and techniques, comprising the formulation of hypotheses and assumptions; collection and compilation of data; research design and selection of research methods. Examples from field surveys and the formulation of research findings aim at strengthening course and project work capabilities.

With view to secondary school course work and post-graduate studies the content exposes students to map production and basic geodesy. The course apply the scientific knowledge for the formulation of hypotheses and assumptions, collection and analysis of data, selection of research methods and

geographic information tools to display spatial data. Map interpretation and aerial photography analysis complements essential skills in geographic analysis techniques, needed for course work and research. Introductory hands-on lecturing builds necessary experiences in GIS for special application at senior secondary school level, seeking to ensure that all participants share a working knowledge of spreadsheet capabilities.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GIS 3711 Geographic Analysis and Techniques

Proposed NQF Level: 7 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours

Prerequisite: None

Content: The course offers application-oriented insights into scientific methods and techniques, comprising the formulation of hypotheses and assumptions; collection and compilation of data; research design and management; field survey and reconnaissance; as well as the formulation of findings. The course apply scientific knowledge to the selection of computer-assisted spatio- analytical tools supported by GIS and Statistics.Relevant computer-assisted GIS software supports practical components of the course work, seeking to ensure that all participants share a working knowledge of spreadsheet capabilities.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GIS 3732 Geographical Information Systems

Proposed NQF Level: 7 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours

Prerequisite: None

Content: The course introduces students to computer-assisted spatial data processing; development, implementation and functions of geographic information systems; data models and structures; as well as analytical procedures. The content focuses on foundations of mapping, database management and information science, including concepts that are essential to any GIS package. Project work based on the application of GIS to a variety of environmental problem formations complement skill-orientated exercises, offered in the Laboratory for Spatial Analysis, DGHES. Hands-on experiences provide students with advanced skills. They should enable students to master software packages such as ArcView, ArcInfo and IDRISI/ILWIS in order to facilitate the creating of maps of geographical locations and their attributes; the performing of spatial analyses using spatial and attributed data; and the display of results in the form of maps and tables.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHE 3752 Regional Geography

Proposed NQF Level: 7 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: The course familiarises students with concepts of and approaches to Regional Geography and furthers students' comprehension of the complexity of the system "region", comprising regional structures and functions (politico-economic, socio-cultural). It reflects data in distinct regions, emphasising the interaction of local and external factors, forces and processes over distance and time in Namibia, Africa and other continents. The course incorporates aspects of regional disparity and explains regional development against the background of different paradigms and concepts of regional development.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHT 3711 Tourism Management

Proposed NQF Level: 7 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: The course introduces universal principles that structure tourism, the nature and operation of the tourism industry, including impact, development and management issues that arise from this export industry. The content unfolds global aspects of the industry, the role that international organisations may and do play in governing ethics of capitalism, underlying local-regional activities employed by governments in fostering tourism. The focus on tourism-related management principles embraces providers of tourism-directed terrestrial transport and marine cruising, aviation, food, beverages and accommodation. The course offers students exposure to the many challenges that management in tourism is requested to carefully meet in an environment of complex politico-economic, socio-cultural and technical interest, individual and collective.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHT 3732 Tourism Entrepreneurship

Proposed NQF Level: 7 Credits: 16 Contact Hours: 4 hours/week over 14 weeks = 56 contact hours
Prerequisite: None
Content: This course provides students with an informed understanding of entrepreneurship and entrepreneurial business within the tourism industry. Its design offers students scientific techniques of inquiry into enterprises at individual, firm and societal levels of analysis. The content builds an understanding for psychological, sociological and economic concepts of enterprise and entrepreneurship, enabling students to comprehend how these ideas relate to practice. The course demonstrates to students how to possibly work successfully in business as well as pointing out possible pitfalls, assuming that this knowledge may assist graduates in applying their entrepreneurial skills successfully.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

FOURTH YEAR LEVEL

GHT 3800 Tourism Studies

Proposed NQF Level: 8 Credits: 16 Contact Hours: 2 hours/week over 28 weeks = 56 contact hours
Prerequisite: Admission to the fourth year level
Content: Students acquaint themselves with the generation and application of complex data sets for tourism planning and development with the assistance of principles, theories and trans-disciplinary methods applied to tourism studies. The course responds to the growing significance of and need
for tourism research in Namibia, taking into consideration the growth of the tourism industry and the country's subscription to sustainable development, which require ethical behaviour, informed consumption of natural resources and sharing distribution of wealth.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHR 3801 Remote Sensing (half-course)

Proposed NQF Level: 8 Credits: 8 Contact Hours: 2 hours/week over 14 weeks = 28 contact hours
Prerequisite: Admission to the fourth year level
Content: This course focuses on the physical principles of remote sensing data acquisition and handling, optical and digital image processing techniques, and environmental and scientific applications of remote sensing data from local to global scales.
Specifically, the course deals with the following topics:

1. physical principles of the visible, infrared and microwave section of the electromagnetic spectrum;
2. remote sensing platforms and sensors;
3. data acquisition, storage and processing;
4. image processing and analysis;
5. remote sensing applications in geosciences.

The course is delivered through a mixture of lectures, tutorials and practicals using remotely sensed data, and practice in digital image processing techniques to provide relevant information for addressing geoscientific issues at a range of temporal and spatial scales.
Assessment: Continuous assessment 60% : Examination 40% (1 x 2 hour examination paper)

GSP 3800 Environmental Management and Governance

Proposed NQF Level: 8 Credits: 16 Contact Hours: 2 hours/week over 28 weeks = 56 contact hours
Prerequisite: Admission to the fourth year level
Content: This course advances students' comprehension of the interdependent functioning whole of the geo-system, biological and human system (geo-ecosystem) through a strong focus on environmental resources and selected environmental problem formations. The content demonstrates the need for conservation and environmental management. Discussions examine academic perspectives and build intellectual skills required in evaluation procedures such as Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA). Practice-orientated assignments apply principles of Integrated Environmental Management (IEM). The course fosters the internalisation of environmental obligations, environmental auditing and environmental ethics needed for sustainable societies.
Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHE 3800 Political Geography

Proposed NQF Level: 8 Credits: 16 Contact Hours: 2 hours/week over 28 weeks = 56 contact hours

Prerequisite: Admission to the fourth year level

Content: This course guides students in studying independently patterns of politico-economic and socio-cultural landscapes in Namibia, Africa and elsewhere. The content addresses complex social processes of change, including deliberations on the regulating role of state and the creation of nations with their local-regional identities and landscapes of power. Lectures investigate phenomena of territorial control, the continuing competition and particular interests of and amongst countries in the ongoing capitalist restructuring of international economies with their shifting centres of politico-economic gravity.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHT 3820 Tourism Planning and Development

Proposed NQF Level: 8 Credits: 16 Contact Hours: 2 hours/week over 28 weeks = 56 contact hours

Prerequisite: Admission to the fourth year level

Content: The course familiarises students with concepts and challenges in tourism planning and development. It discusses the relational nature of tourism planning at international, national, and individual levels of destination. It analyses the role of actors and their responsibilities in tourism planning, both public and private, focusing on the essential role of collaboration and networking. The content emphasises how crucial planning knowledge and application is to the industry, aiming at minimising potentially harmful effects of travel and tourism.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHR 3822 Applied Spatial Analysis (half-course)

Proposed NQF Level: 8 Credits: 8 Contact Hours: 2 hours/week over 14 weeks = 28 contact hours

Prerequisite: Admission to the fourth year level and HGHR 3801 Remote Sensing

Content: This course allows students to deepen their previously acquired skills in geographic analysis and techniques (HGIS 3711), GIS (HGIS 3732) and Remote Sensing (HGHR 3801) by applying them in a wide range of areas such as environmental impact assessment, water resources management, environmental modelling, and terrain analysis. It is designed to develop students' applied vocational and professional skills relevant to work or research. The content is essentially pegged to the course HGHE 3810: Research Project in Geography and Environmental Studies, in which geostatistic, GIS and / or Remote Sensing could be employed as a major tool.

Assessment: Continuous assessment 100% (Project and poster presentation)

GHT 3840 Tourism Marketing

Proposed NQF Level: 8 Credits: 16 Contact Hours: 2 hours/week over 28 weeks = 56 contact hours

Prerequisite: Admission to the fourth year level

Content: The course looks at core concepts and principles that underpin the tourism marketing process. It examines special features of market research and analysis, consumer behaviour, branding, pricing and planning, relating to tourism. The content considers the practice of marketing with view to changing business environments, responding to concepts that put the customer/consumer first.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

GHT 3810 Research Project in Tourism Management Studies

Proposed NQF Level: 8 Credits: 32 Contact Hours: 2 hours/week over 28 weeks = 56 contact hours

Prerequisite: Admission to the fourth year level

Content: This course represents a research component for which the student will select a research topic from one of the Courses the Section: Geography and Environmental Studies offers at fourth year level (NQF Level 8), in consultation with the Department of Geography, History and Environmental Studies. Students will initially attend lectures in research methodology. After selection of a topic, each student will prepare and present a structured research proposal to her/his supervisor by the required deadline. Following approval of the research proposal, the student will conduct her/his research and write a research project of between 10 000 and 15 000 words according to Departmental guidelines and with the guidance of her/his supervisor. Students will be required to attend regular Departmental research seminars during the year where they will report on the progress of their research.

Assessment: Continuous assessment 100% (research project)

SOG 3820 Rural Sociology

Proposed NQF Level: 8 Credits: 16 Contact Hours: 2 hours/week over 28 weeks = 56 contact hours

Prerequisite: Admission to the fourth year level

Content: The course utilises both lecture and seminar format. It examines the meaning of work in society. It reviews demographic, cultural, spatial and other conceptions of rurality. It examines agriculture, wildlife, fishing, forestry and other natural resources as bases for Namibia's and southern Africa's rural economies. It analyses inequalities in land wealth and poverty and associated patterns such as migration. It examines changes to rural areas in the age of globalisation.

Main topical areas of the debate: rural social groups (men and women, elderly and youth), rural people as peasants, land (use, tenure, distribution and reform) land and environmental degradation, rural poverty, migration, natural resources, agriculture and development.

Assessment: Continuous assessment 60% : Examination 40% (1 x 3 hour examination paper)

J. OLD CURRICULUM

Students registering for old curriculum programmes in 2021 should refer to 2017 Prospectus.

J.1. QUALIFICATIONS OFFERED BY THE FACULTY UNDER OLD CURICCULUM

The Faculty may award the following Undergraduate degrees:

UNDERGRADUATE PROGRAMMES

IN 2020 THE OLD CURRICULUM STUDENTS WILL REGISTER FOR THE QUALIFICATIONS BELOW IF THEY DID NOT PASS MODULES REGISTERED FOR IN 2019.

CODE	MAJOR/MINOR	DEGREE	MINIMUM DURATION
11BEGL	Environmental Biology / Geology	Bachelor of Science Honours	4 years full-time
11BEGH	Environmental Biology Geography	Bachelor of Science Honours	4 years full-time
11BMIC	Micro Biology/ Chemistry	Bachelor of Science Honours	4 years full-time
11BMIB	Micro Biology/ Biochemistry	Bachelor of Science Honours	4yearsfull-time
11BMOC	Molecular Biology/Chemistry	Bachelor of Science Honours	4 years full-time
11BMOB	Molecular Biology/Biochemistry	Bachelor of Science Honours	4 years full-time
11BCHP	Chemistry/Physics	Bachelor of Science Honours	4 years full-time
11BCHB	Chemistry/Biology	Bachelor of Science Honours	4 years full-time
11BCHG	Chemistry/Geology	Bachelor of Science Honours	4 years full-time
11BCBB	Biochemistry/ Biology	Bachelor of Science Honours	4 years full-time
11BCBC	Biochemisty/ Chemistry	Bachelor of Science Honours	4 years full-time
11BCMI	Computer Science/Information Technology	Bachelor of Science Honours	4 years full-time
11BCMM	Computer Science/Mathematics	Bachelor of Science Honours	4 years full-time
11BCMS	Computer Science/Statistics	Bachelor of Science Honours	4 years full-time
11BGLY	Geology	Bachelor of Science Honours	4 years full-time
11BMAS	Mathematics/Statistics	Bachelor of Science Honours	4 years full-time
11BMAC	Mathematics/Computer Science	Bachelor of Science Honours	4 years full-time
11BMAP	Mathematics/Physics	Bachelor of Science Honours	4 years full-time
11BPHM	Physics/Mathematics	Bachelor of Science Honours	4 years full-time
11BPHG	Physics/ Geology	Bachelor of Science Honours	4 years full-time
11BPHC	Physics/ Computer Science	Bachelor of Science Honours	4 years full-time
11BPHH	Physics/ Chemistry	Bachelor of Science Honours	4 years full-time
11BSTC	Statistics/Computer Science	Bachelor of Science Honours	4 years full-time
11BSTP	Statistics/ Population Studies	Bachelor of Science Honours	4 years full-time
11BSTM	Statistics/Mathematics	Bachelor of Science Honours	4 years full-time
11BSTE	Statistics/ Economics	Bachelor of Science Honours	4 years full-time
11BPGE	Population Studies/Geography	Bachelor of Science Honours	4 years full-time
11BPST	Population Studies/Statistics	Bachelor of Science Honours	4 years full-time
11BPSO	Population Studies/Sociology	Bachelor of Science Honours	4 years full-time

OLD CURRICULUM	CODE	DIPLOMA/DEGREE	MINIMUM DURATION
	11BSCI	Bachelor of Science	4 years full-time

L. PART-TIME COURSE/DISTANCE EDUCATION

The Faculty of Science does not offer a part-time curriculum. Some courses may be offered in the evening due to the time - table division. Prospective students should contact the Faculty Officer/Head of Department for further information. Part-time studies see Faculty Prospectus: Centre for External studies.

M. GENERAL INFORMATION

All general information as well as the general examination dates and the dates for registration appear in the General Information and Regulations Prospectus.

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