CORRESPONDENCE

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VISION & MISSION STATEMENT

VISION

A University Leading in Engaged Scholarship

MISSION

The University of Venda produces graduates that are locally relevant and globally Competitive

THE CALENDAR IS OBTAINABLE IN THE FOLLOWING SEPARATE PARTS:

FACULTY OF SCIENCE, ENGINEERING AND AGRICULTURE

ADMINISTRATIVE STAFF MEMBERS:

Executive Dean : Prof N Mokgalaka-Fleischmann, DTech Chem (TUT), MBA (Haaga-Helia University, Finland)
Former Dean-School of Agricultural Sciences : JJO Odhiambo, BSc (Agric) (Hons), MSc (Agric) (Nairobi), PhD (British Columbia, Canada)
Former Dean-School of Environmental Sciences : Prof Odiyo [deceased]
Former Dean-School of Mathematical and Natural Sciences : N Potgieter, BSc (RAU), MSc, PhD (UP)
Executive Secretary 1 : LH Kone
Executive Secretary 2 : N Mulovhedzi, N. Diploma Management Assistant (CTC)
Executive Secretary 3 : MB Mantshimuli, (BBA)
School Administrator 1 : MM Maboho, BCom (Univen)
School Administrator 2 : NP Khakhu, BA, HED (Univen)
School Administrator 3 : LD Dongola, BA (Hons) (Univen)

RESEARCH PROFESSORS:

Research Professor : PO Bessong, PhD (Univen), Postdoc (Virginia, USA)
Research Assistant : LG Mavhandu-Ramarumo, PhD (Univen)

VUWANI SCIENCE RESEARCH CENTRE:

Coordinator : NE Maluta, BSc (Hons) (Unin), MSc (Univen), PhD (Bath, (UK)
Lab Technicians : SM Mathebe Bsc (Hons) (Univen)

NRF SARCHI CHAIR:

Coordinator : SH Foord, PhD (UP)

ACADEMIC STAFF MEMBERS:

(Interim Heads of Departments are indicated by means of an asterisk*)

Department: Agricultural Economics and Agribusiness

Professors : IB Oluwatayo, BSc Hons (Agric Econs), MSc, PhD (Ibadan)
Senior Lecturers : *EN Raidimi, BSc (Agric.) (Hons) (UFH), MSc (Agric. Ext) (Reading), PhD (UP)
: M Tshikororo, BSc (Agric) (Unizul), MSc (Agric) (Univen), PhD (Agric) (Univen)
Lecturers : TA Nefale, BSc (Agric), MSc (Univen)
Teaching Assistants : BC Mokwite, BSc (Agric) Univen

Department: Agricultural and Rural Engineering

Senior Lecturers : *MO Marenya, BSc (Hons)(Agric.Eng), MSc(Agric.Eng)(Nairobi), PhD(Agric. Eng) (UP)
Lecturers : FCM Onyando, BSc (Hons.) Environmental & Biosystems Eng., Nairobi, MSc (Agric. Eng.) (UKZN), PhD (Bioresources Eng.,) (UKZN), Cand. Eng. (ECSA)
nGAP Lecturers : DC Sambo, BSc (Agric)(Univen), MSc (Bioresources Systems) (UKZN), PhD (Bioresources Systems, Pr. Nat. Sci.(SACNASP)
Chief Lab Technician : MB Mongwai, BSc (Agric.) (Univen)
Teaching Assistants : DS Monyetsware BSc Agric (Agric and Rural Engineering), MSc Agric (Agric Mechanization)

Department: Animal Science

Associate Professor : *JJ Baloyi, BSc(Agric)(Hons)(UZ), MSc (UK), PhD (UZ)
Senior Lecturers : E Bhebhe, Dip.Agric (Chibero), BSc(Agric)(Hons) (UZ); MSc; PhD (Texas A&M) (USA)
: F Fushai, BSc(Agric) (Hons) (UZ); MSc (Natal); PhD (Unisa)
: MS Mikasi, BSc(Agric), MSc(Agric.)(Univen), PhD(Agric)(Univen), PG Dip(HE)(UKZN)
: AJ Netshipale, BSc(Agric)(Univen), MSc(Agric)(Natal), PhD(WUR), PG Dip(HE)(UKZN)
Chief Farm Technicians : KT Mahlako, BSc(Agric),MSc(Agric)(Univen),PG Dip(HE)(SU)
Chief Principal Lab Techs : EM Nyathi, BSc, MPH (Univen)
Lab Technicians : AM Raseona, BSc(Agric)(UL); MSc(Agric)(Univen)

Department: Biochemistry and Microbiology

Professors	: *A Shonhai, BSc (Hons) (NUST), PhD (Rhodes)
	: N Potgieter, BSc (RAU), MSc, PhD (UP)
Associate Professors	: A Samie, BSc (Hons), MSc (Yaoundé, Cameroon), PhD (Univen)
	:AN Traore, DEUG B, Licence, Maitrise (UJF, Grenoble, France); MSc (RAU), PhD (UJ)
	: NE Madala, PhD (UJ)
Senior Lecturers	: ME Musie, BSc (Wits), BSc (Hons), MSc, PhD (Univen)
	: J Kabue-Ngandu, MSC (SU), PhD (Univen)
	: MT Sigidi BSc (Hons) (UKZN), MSc, PhD (Univen)
	: A Burger, BSc (Hons) (UP), MSc, PhD (Rhodes)
Lecturers	: SC Tshidino, BSc; BSc Hons (UNIVEN); MSc; PhD (NMU); PGDHET (UFH)
	: L Mathomu MSc (Unisa)
Senior Lab Technicians	: M Magwalivha, BSc (Hons) (Univen), MSc (UP)
Lab Technicians	: DC Mmboyi, BSc (Hons) (Univen)
	: C Ndou, BSc (Hons) (Univen)

Department: Biological Sciences

Professors	: Y Moodley PhD (UCT)
	: SH Foord, PhD (UP)
Associate Professors	: *IEJ Barnhoorn PhD (UJ), Postdoc (UP)
	: MP Tshisikhawe, BSc (Hons), MSc (Univen), PhD (UP), (Rhodes)
Senior Lecturers	: MH Ligavha-Mbelengwa, BSc (Hons), BEd (Univen), MSc (UCT) UED, SABUFSEP (North Carolina A&T State, USA)
	: LI Ramovha, BSc (Unin), BSc (Hons) (Univen), MSc (UP), HED (Postgrad) (Unisa) PhD (UP)
	: NA Masevhe, BA, BSc (Hons), UED, MSc (Univen), PhD (UP)
	: CS Schoeman, MSc (US), PhD (Univen)
	: LH Swanepoel, PhD (UP)
Lecturers	: GJ Madonsela, MSc (UDW)
	: H Roux, MSc (UJ)
	: HE Munzhelele, MSc (Univen)
	: S Hugo, PhD (UP)
	: RT Tshivhandekano, B.Sc (Univen), BSc (Hons), MSc (UCT), M.Env.Man (PU for CHE)
	: N Swelankomo BSc (Hons) (Unitra), MSc (US)
Chief Lab Technicians	: K Magwede, BA, UED, MSc (Univen), PhD (UJ)
Lab Technicians	: MG Phaphana, BA, UED (Univen)
	: MP Legodi, BSc (Hons) (Unin), MSc (UL)

Department: Chemistry

Associate Professors	: IDI Ramaite, BSc (Hons) (Univen), PhD (Rhodes), PrChem SA
	: Prof M Kabanda, Associate prof, PhD, MSc all from Univen
Senior Lecturers	: *SS Mnyakeni-Moleele, BSc (Hons), PhD (WITS), PrChem SA
	: MA Legodi, BSc (UCT), BSc (Hons) (Unin), PhD (UP), PrChem SA
	: LC Murulana, BSc (Univen), BSc (Hons), MSc, PhD (North West), PrChem SA
	: E Batisai, BSc (Hons), MSc, PhD (SU)
	: N Tavengwa PhD (WITS), PrChem SA
Lecturers	: LR Puka, BSc, BSc (Hons) (VISTA), MSc (RAU)
	: TE Ramurafhi, MSc (Medunsa)
Senior Lab Technicians	: FB Mutshaeni, BSc Hons (Univen) PrChem SA
	: NR Maseko, BSc (Wits), BSc (Hons) (Univen)
NMR Operators	: P Pandelani, BSc (Hons)(Univen)

Department: Earth Sciences

Senior Lecturers	: *MO Kataka, BSc (Hons), MSc (Unv. Nairobi), PhD (Wits), Cert. (IISEE, Tsukuba), Cert (UPPSALA), Cert (Potsdam), Cert (NIAG, Cairo), Cert. (Strata Control)
Associate Professors	: JR Gumbo, BSc & Msc (Univ.Zim), MSc & PhD (UP) PrSci.Nat.
Senior Lecturers	: FA Dacosta, BSc (Hons) (KNUST), MSc (Wits), PhD (Wits), MIECA
	: L Diko, BSc (Hons), MSc (Buea), PhD (UL), Cert. Post Graduate Supervision (RU), MIMGA, MCMS, MGSA, MYES, MACCMRG, MMIWSA
	: JN Edokpayi, B.Tech (LAUTECH), Postgrad.Diploma (NTI), MSc (ABU), PhD (Univen), SAYAS Fellow
	: HR Mundalamo, BSc (Unin), BSc (Hons), MESC, PhD (Univen), MGSSA
	: R Makungo, BESHWR, MESCH, PhD (Univen), MGSSA, MWISA

: FI Mathivha, BESHWR, MESHWR, PhD (Univen)
: SE Mhlongo, BESMEG, MESMEG, PhD (Univen), PGDip.HE (RU), MGSSA, MLaRSSA, SAYAS Fellow

Lecturers : TR Nkuna, BESHWR, MESHWR (Univen), Pr. Sci. Nat, MIAH, MGSSA
: MI Mutoti, BESHWR (Univen), MSc EWS (UWC)
: NA Mahlaule, BESMEG, MESC (Univen), MGSSA
: N Rembuluwani, BESMEG, MESMEG (Univen), PGDip.HE (UKZN), MGSSA, MSEG
: L Tshilate, BESMEG, MESMEG (Univen)

Senior Technician : N Lilimu, BESMEG (Univen), SACNASP, GSSA

Technicians : E Malima, BESHWR (Univen)
: N Nemapate, BESMEG, MESC (Univen), MGSSA

Department: Food Science and Technology

Professors : AIO Jideani, BSc(Hons), MSc(Food Tech)(Ibadan), PhD(Leeds), PG Dip(Food Tech)(Ibadan)

Senior Lecturers : *SE Ramashia, BScFST (Univen), MTech(Food Tech)(TUT), PhD(Univen), PGDip. HE (UKZN)
: H Silungwe, Dip. Agric. Eng. (UNZA), BSc (Agric) (UNISWA), MSc. (Agr.Eng.Tech) (Food Processing) (UCD-Ireland),PhD (Univen)

Lecturers : T E Kgatla, BSc(FST)(Univen), Master of Nutrition(UL)
: M E Mashau, BInstAgrar (Food Processing) (UP), MSCFST(Univen),PGDip.HE (UKZN)
: MT Malaza, B Home Economics (Education) (UWC), B Consumer Science (Hons) (UP), Masters in Consumer Science (UP)

Pilot Plant Technicians : N J Matodzi, BSc FST (Univen)

Lab Technicians : B Nethathe, BSc (Univen); BSc(Hons), MSc (UFH), PhD (UP)
: T Mokhele, BInstaAgrar (Food Processing) (UP), MSc (Agric) (Unisa)
: B Moyo, BSc, BSc (Hons) (Unisa), MSc (Chemistry) (Univen)
: M Mulondo, BFECS, HONRDV (Univen)

Department: Forestry

Professors : *PO Adesoye, B.Agric.Tech (Forestry & Wood Tech)(FUTA), M. Agric. Tech)(Forest Mgt)(FUTA), PhD(Forest Biometrics)(UI)

Senior Technicians : P Munyanduki, BSc (Hons) (Forest Resources and Wildlife Mgt) (NUST), MSc (Forest Mgt & Environment) (UP)

Department: Geography and Environmental Sciences

Associate Professor(s) : BDO Odhiambo, BSc. (Hons), MSc. (Univ. Nairobi), PhD (Waterloo), PGDip. Geomorphology (ITC, Netherlands), Cert. Remote Sensing (GDT/CNES Toulouse, France).

Senior Lecturers : *NS Nethengwe, PhD, Geography (West Virginia University, USA).
: JN Steyn, BSc (Agric) (UOFS), BSc (Hons) (UP), MEnvM (UOFS), PhD EnvSc. (Univen)
: L Mugwedi, B.Agric (UNIVEN), B.Inst Agric (Hons) (UP), MSc. (WITS), PhD (UKZN)
: R Mudzielwana, BEMVM, MEnvSc, PhD. EnvSc (Univen)
: EM Stam, MSc (Univ. Amsterdam), PhD (Free University, Amsterdam)
: OE Malahlela, BScEnvSc (Hons) (UL), MSc (UKZN), PhD (UP), SACNSP.
: TM Nelwamondo, BPEd, BPEd BSc (Hons) (Fort Hare), MA (Univ. PE); PhD (UP)
: NV Mudau, BA (Hons), MEnvSc (Univen), PhD (NWU), UED (Univen)
: MJ Mokgoebo, B.Ped (Arts), BA Hons (Geo) (UKZN:Westville), PGDHE (UKZN: Howard), MEnv.Sc (Univen), PhD (Env.Man) UNISA

Lecturers : R Mulaudzi, B.Envsc (Hons) (Univen), BA Development Studies (Hons) (UNISA), MEnvsc (Univen)
: FM Murungweni, BSc. (ZOU), MSc. (University of Twente, Netherlands), Dip. Geo-information (ITC, Netherlands), SACNASP, AARSE
: E Kori, BSc (Hons) (Midlands State, Zimbabwe), MEnvSc (Univen), PGDip.HE (UKZN)
: KH Netshisaulu, BEnvSc, BEHGEO, MEnvSc (Univen)

Department: Mathematical and Computational Sciences

Professors : S Shateyi, BSc (Hons), MSc, DPhil (UZ)
: W Garira, BSc (UZ), MSc (UK), PhD (London)

Senior Lecturers : *S Moyo, MSc (PFUR-USSR), PhD (Brunel, London-UK)
: JC Ndogmo, PhD (Montreal, Canada), DEA (Louis Pasteur of Strasbourg University, France)
: KA Kyei, BSc (Hons), PGD (Ghana), DD, MD, (UCL, Louvain-La-Neuve, Belgium), PhD (UP)

: C Sigauke, BEd (UZ), MSc (NUST), PhD (UFS)
: A Bere, BSc (Hons), MSc (Zimbabwe), PhD (UWC)
: K Muzhinji, Dip.Ed. (UZ), BSc. Ed (Hons), (Bindura University of Science Education, Zimbabwe), MSc (TU Kaiserslautern, Germany), MSc (Johannes Kepler, Austria), PhD (Univen)

Lecturers
: MA Luruli, BSc (Georgia Statey, USA), MSc (Clar Atlanta), (USA)
: FS Netshapala, BSc (Ed), BSc (Hons) (Univen), MSc (UP)
: RM Mukhodobwane, BA (Hons) (Univen), HED, BEd (Unisa), MSc (Univen)
: D Mathebula, BSc (Hons) (Univen), MSc (US), PhD (Univen)
: M Mohlala, BSc (Hons) (KZN), MSc, DPhil (Howar University)
: AD Maphiri, BA, BSc, MSc, PGDE, (Univen)
: A Manthada, BSc (Hons), PGDE, MSc (Univen)
: IR Makgatho, BSc (Hons)(Unisa), Business and Administration (Hons) (Stellenbosch), MSc, HED (Limpopo)
: VT Makhoshi BSc, (Hons), UED, MSc (Univen)
: G Dzawo, BSc, MSc (NUST, Zimbabwe); PG Dip (CHE) (RU)
: N Soganile, BSc (Cuba), MSc (NUST, Zimbabwe),PG Dip (RU)
: B Moyo, BSc (Havana, Cuba), MSc (NUST, Zimbabwe), PhD (NWU)
: TB Mulaudzi, BSc (Hons) (UNIN), MSc (Univen)
: TH Tshisikhawe, BSc (Hons), MSc (Univen)
: TL Kubjana, MSc (UWC)
: N Mukwevho BSc Hons, MSc (Univen), PGCE(UNISA)
: N Ndou, BSc, BSc (Hons), MSc (Univen)

Department: Physics

Senior Lecturers
: JK Kirui, BSc (Hons) (NairobI), MSc (British Columbia), PhD (Wits)
: *NE Maluta, BSc (Hons) (Unin), MSc (Univen), PhD (Bath University), (UK)
: D Tinarwo, Lic. Ed (Phy) (Jose' Varona, Cuba) BSc (Hons), MSc (Zimbabwe), PhD.Ing (Germany)

Lecturers
: L Jhamba, BSc (Hons), BEd, MSc, MScEd (Zimbabwe) PhD (Wits)
: F Nemangwele, BSc (Univen), BSc (Hons), MSc (UWC), PhD (Univen)
: TS Mulaudzi, BSc.Ed, BSc (Hons), MSc, PhD (Univen)
: L Phuthu

Senior Lab Technicians
: TS Ravhengani, MSc (Univen)

Lab Technicians
: TT Khedzi, BSc Hons (Univen)
: S Mathebe BSc (Hons) (Univen)

Department: Plant and Soil Sciences

Professors
: ET Gwata, BSc (Crop Science) (Univ Novi Sad), MSc (Univ. of Melbourne), PhD (Univ. of Florida)
: JJO Odhiambo, BSc (Agric)(Hons), MSc (Agric)(Nairobi), PhD (Soil Science) (Univ. of British Columbia, Canada)
: JBO Ogola, BSc (Agric) (Hons), MSc (Nairobi), PhD (Reading)

Associate Professors
: *GRA Mchau, Dip (Horticulture), BSc (Fruit Ind.), MSc (Agric) (California State Polytechnic Univ., Pomona), PhD (Plant Pathology) (University of California)

Senior Lecturers
: J Mzezewa, BSc (Agric)(Hons)(UZ), MSc (Agric)(Aberdeen), PhD (Soil Science) (UF)
: O Naicker BSc Microbiology (Hons), UKZN. MSc (Agric) (UNISA), D. Agric Plant Pathology, Jilin Agricultural University (JLAU) in Changchun, China.

Lecturers
: F Thovhogi, BSc (Agric)(Univen), MSc (Stellenbosch)
: ML Ramphinwa, BSc (Agric), MSc (Agric)(Univen)
: TM Maphosa, BSc (Agric), MSc (Agric)(UL)
: HP Nemakundani, BSc (Agric)(Unin), BSc (Agric)(Hons)(UP), Masters in Sustainable Agric (UFS)

nGAP Lecturers
: SG Lusiba, BSc (Agric)(UL); MSc (Agric)(Univen)

Teaching Assistants
: S Thaba, (BSc Agric) (Univen)

Crop Technicians
: MV Makhado, B (Agric) (Hons)(Univen), MSc (Agric) (UL)

Lab Technicians
: T Leboho, B(Agric) (Hons)(Univen), M (AgricManag) (UL)
: SE Rapholo BSc (Agric)(Univen) MSc (Agric) (Univen)

Science Foundation

Professors
: *S Shateyi, BSc (Hons) (NUST), MSc, DPhil (Zimbabwe)

Lecturers
: RS Pearce, MSc (UWC)
: GM Mokganya, MSc (Univen)
: O Matsilele, BSc (Hons) (Univen)

	: VM Nekhubvi, BSc (Hons), MSc (Univen)
Junior lecturers	: I Zitha

Department: Urban and Regional Planning

Professors	: P Bikam, BSc, MSc (Univ. of Tours, France), MPhil, (Paris Sorbonne, France), PhD (Univ. of Paris Sorbonne, France), Diploma in Cartography (Kaduna Polytechnic Kaduna, Nigeria), SACPLAN, SAPI.
Senior Lecturers	: *I Ingwani, BEd, MSc (Univ. of Zimbabwe), PhD (Stellenbosch), Diploma (project planning), Diploma Ed (Univ. of Zimbabwe), SACPLAN, SAPI, ZIRUP
Lecturers	: T Gondo, BSc (Hons) and MRUP (Uni.Zim), PGDip. HE (Stellenbosch)
	: SA Nyamwanza, BURP (Univen) MURP (Univen), MSc DP (Wits), SACPLAN Pr. TP. SAPI
Senior Technologists	: FV Mushiana, B.Arch (Hons) (Denmark), M.Arch (London), N. Diploma Arch (TUT), Cert. Arch (DDA), CAD Cert. (TUT), SAIBD, SAIAT, SACAP.
Junior Technicians	: SG Tshikunde, B.Tech, N.Dip Town and Regional Planning (UJ), SACPLAN

Institute for Rural Development

Associate Professors	: *J Francis, BSc (Agric)(Hons), MPhil, PhD(UZ)
Senior Lecturers	: G Oloo, BSc, MBA(USIU), Dip HRM(Manchester), Cert MF(Cranefield),
	: B Kilonzo, Dip. Community Empowerment(Israel), BA(Rani Durgavati), MA(Agra), PhD(Univen)
	: M. Manjoro, BSc(Agric)(Hons), MSc Agric(UZ); PhD (UFH)
	: J Zuwarimwe, BSc(Hons)(Rural & Urban Planning), MSc(Rural Econ.Dev Plan)(UZ), PhD(UP)
Lecturers	: MA Mathaulula, SSTD, BPaed(Home Econ.)(Unizul), PGDTE, PGDEM(Unisa), HONRDV(Univen), MRDV (Univen), PhDRDV(Univen)
Farm Managers	: TG Kutama, N.Dip.(Animal Prod.)(Pret Tech.), B Tech.(Agric Mgt) (Unisa), BAgric (Hons)(Univen)

SECTION 1:

QUALIFICATIONS WITH OLD CODES IN THE FACULTY TO BE TOTALLY PHASED OUT IN 2022 OR NOT OFFERED IN 2022

• DIPLOMA (FRESHWATER TECHNOLOGY)	DIPFWT
• BACHELOR OF SCIENCE (BIOCHEMISTRY AND MICROBIOLOGY)	BSCBCM
• BACHELOR OF SCIENCE (BIOCHEMISTRY AND BIOLOGY)	BSCBCB
• BACHELOR OF SCIENCE (MICROBIOLOGY AND BOTANY)	BSCMB
• BACHELOR OF SCIENCE (BOTANY AND ZOOLOGY)	BSCBZ
• BACHELOR OF SCIENCE (COMPUTER SCIENCES)	BSCCSI
• BACHELOR OF SCIENCE (COMPUTER SCIENCE AND MATHEMATICS)	BSCCOM
• BACHELOR OF SCIENCE (MATHEMATICS AND APPLIED MATHEMATICS)	BSCMAM
• BACHELOR OF SCIENCE (FINANCIAL MATHEMATICS AND APPLIED MATHEMATICS)	BSCFMA
• BACHELOR OF SCIENCE (MATHEMATICS AND STATISTICS)	BSCMST
• BACHELOR OF SCIENCE (STATISTICS AND ECONOMICS)	BSCSTE
• BACHELOR OF SCIENCE (MATHEMATICS AND PHYSICS)	BSCMP
• BACHELOR OF SCIENCE (PHYSICS AND CHEMISTRY)	BSCPC
• BACHELOR OF SCIENCE (CHEMISTRY AND APPLIED CHEMISTRY)	BSCCAC
• BACHELOR OF SCIENCE (CHEMISTRY AND MATHEMATICS)	BSCCM
• BACHELOR OF SCIENCE (CHEMISTRY AND BIOCHEMISTRY)	BSCCHB
• BSc HONS (BOTANY)	BSCHBT
• BSc HONS (CHEMISTRY)	BSCHCHE
• BSc HONS (BIOCHEMISTRY)	BSCHBCM
• BSc HONS (COMPUTER SCIENCES)	BSCHCOM
• BSc HONS (MATHEMATICS)	BSCHMAT
• BSc HONS (APPLIED MATHEMATICS)	BSCHMAT
• BSc HONS (STATISTICS)	BSCHSTA
• BSc HONS (PHYSICS)	BSCHPHY
• BSc HONS (MICROBIOLOGY)	BSCHMBY
• BSc HONS (ZOOLOGY)	BSCHZOO
• MSc (BOTANY)	MSCBOT
• MSc (CHEMISTRY)	MSCCHE
• MSc (BIOCHEMISTRY)	MSCBCM
• MSc (MATHEMATICS)	MSCMAT
• MSc (APPLIED MATHEMATICS)	MSCMAT
• MSc (STATISTICS)	MSCSTA
• MSc (PHYSICS)	MSCPHY
• MSc (MICROBIOLOGY)	MSCMBY
• MSc (ZOOLOGY)	MSCZOO
• PhD (BOTANY)	PHDBOT
• PhD (CHEMISTRY)	PHDCHE
• PhD (BIOCHEMISTRY)	PHDBCM
• PhD (MATHEMATICS)	PHDMAT
• PhD (APPLIED MATHEMATICS)	PHDMAT
• PhD (STATISTICS)	PHDSTA
• PhD (PHYSICS)	PHDPHY
• PhD (MICROBIOLOGY)	PHDMBY
• PhD (ZOOLOGY)	PHDZOO

PLEASE NOTE:

THE FOLLOWING SECTIONS ARE FOR STUDENTS WHO WERE REGISTERED FROM 2020 ON THE NEW QUALIFICATIONS AND MODULE CODES FOR UNDERGRADUATE AND POSTGRADUATE STUDIES.

STUDENTS WHO WERE REGISTERED BEFORE 2020 ON THE OLD QUALIFICATION CODES FOR UNDERGRADUATE AND POSTGRADUATE QUALIFICATIONS, MUST LIAISE WITH THE FACULTY ADMINISTRATOR AND THE EXECUTIVE DEAN ON ISSUES WITH REGISTRATION

SECTION 2:

GENERAL RULES IN THE FACULTY

2.1. SERVICE MODULES:

(a) Students intending to register for service modules will only be permitted in accordance with a predetermined number of students for the relevant department and will only be permitted to register for modules for which they fulfil the pre-requisites of the modules.

2.2. MODULES FOR NON-DEGREE PURPOSES:

(a) Students wishing to enroll for such modules must consult the appropriate Head of the Department and the Executive Dean of the Faculty.
(b) A written application to this effect must be provided by the student and given to the Faculty Administrator who will confirm if the student qualifies for the additional modules.
(c) The application letter will then be approved/not approved by the HOD of the relevant Department(s) and final approval will be given by the Faculty Executive Dean before it is send to RAC for final decision.

2.3. CREDIT FOR MODULES PASSED ELSEWHERE:

(a) Accepted candidates may, subject to University rules receive credit for modules completed at another recognized University towards a degree of this University, on application to the SENEX and Senate.
(b) Candidates holding a Diploma in Agriculture from a recognized Tertiary Institution may be exempted from certain modules on recommendation by the Faculty and approval by Senate. For students who are granted exemption, there may be restrictions on the choice of disciplines.

2.4. REGISTRATION FOR SPECIFIC QUALIFICATION OFFERED BY FACULTY:

(a) Candidates may be admitted as students in the Faculty based on relevant prior learning. Such candidates will be subjected to an evaluation by the School's Assessment and Recognition of Prior Learning (ARPL) committee. Final admission will only be granted by SENATE.
(b) Each qualification has its own registration qualifications clearly listed – students are requested to make sure they qualify fully for the specific qualification they are applying for.

2.5. REGISTRATION OR CANCELLATION OF MODULES AND CHANGE OF MODULE REGISTRATION:

(a) There will be a semester deadline for registration/cancellation and change of modules each semester and students must adhere to these deadlines
(b) Students must make sure to fill in the correct Faculty form for the cancellation/registration of modules
(c) Student must make sure to adhere to deadlines and must use correct Faculty forms for registration/cancellation of modules and change of module registration
(d) Students will only be allowed to register or change registration for modules if a proff of registration for the current year as well as a full academic record, which includes marks for each module, accompanies the correct Faculty form.
(e) Students will only be allowed to register for a module if the Pre-requisite/s has/have been satisfied except otherwise waived by the Head of Department after consultation and approval by the Executive Dean.

2.6 RE-REGISTRATION AND DEFERMENT OF UNDERGRADUATE OR POSTGRADUATE STUDIES:

(a) For the duration of the degree Programme, a student must register each year by the stipulated date.
(b) Registration each year is subject to the recommendation of the Head of Department and may be rejected in the 2nd year on grounds of unsatisfactory progress.
(c) Students wishing to defer studies at any stage must submit a motivated application beforehand. If granted, such deferment **will be for a period of ONE year only**, after which a further application must be submitted. Deferment will, **at most, be granted twice**.

SECTION 3:

DEPARTMENT: BIOCHEMISTRY AND MICROBIOLOGY

3.1. QUALIFICATIONS OFFERED BY THE DEPARTMENT OF BIOCHEMISTRY AND MICROBIOLOGY

Generic BSc degrees (BSc):

• BSc (BIOCHEMISTRY AND MICROBIOLOGY)		CODE:	MNBBSA
• BSc (BIOCHEMISTRY AND BIOLOGY)		CODE:	MNBBSD
• BSc (MICROBIOLOGY AND BOTANY)		CODE:	MNBBSE
• BSc (CHEMISTRY AND BIOCHEMISTRY)		CODE:	MNBBSL

BSc Hons degrees (BSc.Hons)

• BSc HONS BIOLOGICAL SCIENCES (BIOCHEMISTRY)		CODE:	MNHHBC
• BSc HONS MICROBIOLOGY		CODE:	MNHSMH

MSc degrees (MSc):

• MSc BIOCHEMISTRY	Project: BCM 6300	CODE:	MNMMSB
• MSc MICROBIOLOGY	Project: MBY 6300	CODE:	MNMMMS

PhD degrees (PhD):

• PhD BIOCHEMISTRY	Project: BCM 7300	CODE:	MNPDPB
• PhD LIFE SCIENCES (MICROBIOLOGY)	Project: MBY 7300	CODE:	MNPLSM

3.2. GENERIC BSc QUALIFICATION OFFERED IN THE DEPARTMENT OF BIOCHEMISTRY AND MICROBIOLOGY [CREDITS = 360]:

3.2.1 ADMISSIONS REQUIREMENTS, RULES FOR PREGRESSION AND ASSESSMENT CRITERIA FOR THE GENERIC BSC QUALIFICATION

ADMISSIONS REQUIREMENTS	(a) Candidates wishing to enroll for a Generic BSc degree in the Department of Biochemistry and Microbiology in any of the undergraduate qualifications listed, must have obtained a minimum admission requirement in a National Senior Certificate (NSC) as certified by the Council for General and Further Education and Training (Umalusi) with an achievement rating of **4** (adequate achievement, 50-59%) or better in **each** of the following four recognised 20-credit NSC subjects: • English • Mathematics • Physical Science • Life Sciences (b) Any other related subject as judged by the HOD of the responsible department and approved by the Executive Dean of the Faculty (c) Candidates may be subjected to a selection procedure as determined by the Faculty board. (d) Equivalent FET Level 4 qualifications in any of the above subjects may also be considered. (e) Students from the Extended BSc Degree Programme should have obtained 120 credits from the 12 modules registered for, before admission to the listed mainstream degree.
RULES FOR PROGRESSION	**Students from the foundation year:** (a) All outstanding Foundation year modules **must be** registered for and passed during year 2 of the extended programme. (b) Students will not be allowed to move to year 3 of the extended programme or take any second-year mainstream modules if they still have **outstanding extended/foundation 1st year modules**. (c) A third-year extended programme student who has passed 60% of his/her second-year modules **may only** register third year modules whose Pre-requisites have been met, subject to the approval of the Head of Department and the Executive Dean. (d) Students may not select modules that clash on the lecturing and practical timetables.

	(e) No curriculum change, whether within or from outside the Faculty, will be recognized unless approved by the Executive Dean. (f) A full-time student may take a maximum of 32 credits over and above the minimum 360 credits required for the degree, **subject to the approval of the Head of Department and the Executive Dean**. (g) Students can register ONLY for modules for which **ALL** pre-requisites have been satisfied. (h) Students retain credits for all modules passed. (i) To qualify for a BSc degree in the Faculty, students must obtain a minimum of half of their credits in a learning stream within the Faculty of Sciene, Engineering and Agriculture. **Students registered for 3 year BSc degree:** (a) A student **may only progress to the second-year level** when she/he has passed 60% of the 1st year modules in the mainstream BSc degree (b) To progress to the third-year level, a student must have passed **ALL** first- and second-year modules. (c) Students may not select modules that clash on the lecturing and practical timetables. (d) No curriculum change, whether within or from outside the Faculty, will be recognized unless approved by the HOD and the Executive Dean. (e) A full-time student may take a maximum of 32 credits over and above the minimum 360 credits required for the degree, **subject to the approval** of the Head of Department and the Executive Dean. (f) Students can register **ONLY** for modules for which **ALL** Pre-requisites have been satisfied**.** (g) Students retain credits for all modules passed. (h) To qualify for a BSc degree in the School of Mathematical and Natural Sciences, students **must obtain a minimum** of half of their credits in a learning stream within this School. (i) To obtain a degree from the School, students must have earned at least 360 credits including all core and fundamental modules in one of the generic Bachelor of Science qualifications. Departments may prescribe additional credits **provided these do not exceed** 32 credits. (j) The minimum registration period for a BSc. degree is three years and the maximum is n+2.
ASSESSMENT CRITERIA	(a) Continuous Assessment will be determined by the Department and approved by the Faculty Board and consist of tests, practical sessions and tests, tutorials, projects, assignments and reports. (b) Students will write examinations at the end of each semester on condition that they qualify to do so. (c) The minimum final pass mark in any module is 50%. (d) To obtain the degree or diploma cum laude, a candidate must attain an aggregate of 75% or higher.

3.2.2. THE FOLLOWING GENERIC BSC QUALIFICATIONS ARE OFFERED IN THE DEPARTMENT OF BIOCHEMISTRY AND MICROIOLOGY

BSc (BIOCHEMISTRY AND MICROBIOLOGY) **[CODE: MNBBSA]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**CHE 1140** (16): General Chemistry for Applied Sciences **BIO 1141** (16): The Tree of Life **BIO 1142** (16): Cell Biology **MAT 1143** (8): Mathematics for Biological, Earth and Life Sciences I **STA 1149** (8): Basic Statistics (for the Natural and Applied Sciences) **COM 0110** (4): Computer Literacy **ECS 1141** (10): English Communication Skills (Generic Module)	**PHY 1125** (8): Physics for Natural Sciences I	**132**
	2	**CHE 1221** (8): Inorganic Chemistry I **CHE 1222** (8): Organic Chemistry I **STA 1249** (8): Basic Statistical Inference (for the Natural and Applied Sciences) **BIO 1243** (16): Ecology, Adaptation and Evolution **COM 0210** (4): Computer Literacy **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**MAT 1243** (8): Mathematics for Life and Earth Sciences II **PHY 1225** (8): Physics for Natural Sciences II	
Year 2 **NQF Level 6**	**1**	**BCM 2121** (10): Structural and Functional Biochemistry I **BCM 2122** (10): Biochemical and Molecular Techniques **MBY 2121** (10): Bacteriology **MBY 2122** (10): Immunology **ZOO 2141** (16): Animal Physiology	**BIO 2142** (16): Population Ecology **BOT 2144** (16): Plant Anatomy and Morphology **CHE 2121** (10): Inorganic Chemistry II **CHE 2122** (10): Organic Chemistry II	**112**
	2	**BCM 2221** (10): Structural and Functional Biochemistry II **BCM 2222** (10): Metabolism **MBY 2223** (10): Environmental Microbiology **MBY 2224** (10): Virology	**BOT 2245** (16): Plant Taxonomy and Reproductive Biology I **BOT 2249** (16): Ethnobotany I **CHE 2220** (10): Analytical Chemistry: Classical Techniques **CHE 2223** (10): Physical Chemistry I **ZOO 2248** (16): Animal Phylogeny	
Year 3 **NQF Level 7**	**1**	**BCM 3121** (16): Protein Biochemistry **BCM 3122** (16): Advanced Molecular Techniques **MBY 3126** (14): Food Microbiology **MBY 3127** (14): Industrial Microbiology	NONE	**120**
	2	**BCM 3221** (16): Enzymology and Enzyme Biotechnology **BCM 3222** (16): Gene Expression, Protein Synthesis and Bioinformatics **MBY 3228** (14): Mycology and Phycology **MBY 3229** (14): Parasitology	NONE	

In year 1:
- Take modules in total of 8 credits from the elective module list
- Take either COM 0110 **OR** COM 0210

In year 2:
- Take modules in total of 16 credits from the elective module list

BSc (BIOCHEMISTRY AND BIOLOGY) **[CODE: MNBBSD]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**CHE 1140** (16): General Chemistry for the Applied Sciences **BIO 1141** (16): The Tree of Life **BIO 1142** (16): Cell Biology **MAT 1143** (8): Mathematics for Biological, Earth and Life Sciences I **COM 0110** (4): Computer Literacy **ECS 1141** (10): English Communication Skills (Generic Module)	**PHY 1125** (8): Physics for Natural Sciences I **STA 1149** (8): Basic Statistics (for the Natural and Applied Sciences)	**120**
	2	**CHE 1221** (8): Inorganic Chemistry I **CHE 1222** (8): Organic Chemistry I **BIO 1243** (16): Ecology, Adaptation and Evolution **COM 0210** (4): Computer Literacy **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**MAT 1243** (8): Mathematics for Biological, Earth and Life Sciences II **PHY 1225** (8): Physics for Natural Sciences II **STA 1249** (8): Basic Statistical Inference (for the Natural and Applied Sciences)	
Year 2 **NQF Level 6**	**1**	**BCM 2121** (10): Structural and Functional Biochemistry I **BCM 2122** (10): Biochemical and Molecular Techniques **BOT 2144** (16): Plant Anatomy and Morphology **ZOO 2141** (16): Animal Physiology **ZOO 2144** (16): Principles of Genetics	NONE	**136**
	2	**BCM 2221**(10): Structural and Functional Biochemistry II **BCM 2222** (10): Metabolism **BOT 2245** (16): Plant Taxonomy and Reproductive Biology I **BOT 2249** (16): Ethnobotany I **ZOO 2248** (16): Animal Phylogeny	NONE	
Year 3 **NQF Level 7**	**1**	**BCM 3121** (16): Protein Biochemistry **BOT 3148** (10): Plant Systematics **ZOO 3141** (16): Animal Ecophysiology	**BCM 3122** (16): Advanced Molecular Techniques	**104**
	2	**BCM 3221** (16): Enzymology and Enzyme Biotechnology **BOT 3246** (10): Plant Physiology **ZOO 3249** (20): Evolutionary Genetics	**BCM 3222** (16): Gene Expression, Protein Synthesis and Bioinformatics **BOT 3241** (10): Ethnobotany II **BOT 3247** (10): Plant Ecophysiology	

In year 1: - Take modules in total of 8 credits from the elective module list
- Take either COM 0110 **OR** COM 0210

In year 3: - Take modules in total of 16 credits from the elective module list

BSc (MICROBIOLOGY AND BOTANY) **[CODE: MNBBSE]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**CHE 1140** (16): General Chemistry for the Applied Sciences **BIO 1141** (16): The Tree of Life **BIO 1142** (16): Cell Biology **MAT 1143** (8): Math for Biological, Earth and Life Sciences I **STA 1149** (8): Basic Statistics (for the Natural and Applied Sciences) **COM 0110** (4): Computer Literacy **ECS 1145** (10): English Communication Skills	**PHY 1125** (8): Physics for Natural Sciences I	**136**
	2	**CHE 1221** (8): Inorganic Chemistry 1 **CHE 1222** (8): Organic Chemistry 1 **STA 1249** (8): Basic Statistical Inference (for the Natural and Applied Sciences) **BIO 1243** (16): Ecology, Adaptation and Evolution **COM 0210** (4): Computer Literacy **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**MAT 1243** (8): Math for Biology, Earth and Life Sciences II **PHY 1225** (8): Physics for Natural Sciences II	
Year 2 **NQF Level 6**	**1**	**MBY 2121** (10): Bacteriology **MBY 2122** (10): Immunology **BOT 2144** (16): Plant Anatomy and Morphology **BIO 2142** (16): Population Ecology	**CHE 2121** (10): Inorganic Chemistry II **CHE 2122** (10): Organic Chemistry II	**118**
	2	**MBY 2223** (10): Environmental Microbiology **MBY 2224** (10): Virology **BOT 2245** (16): Plant Taxonomy and Reproductive Biology **BOT 2249** (16): Ethnobotany I	**ZOO 2248** (16): Animal Phylogeny **CHE 2220** (10): Analytical Chemistry: Classical Techniques **CHE 2223** (10): Physical Chemistry I	
Year 3 **NQF Level 7**	**1**	**MBY 3126** (14): Food Microbiology **MBY 3127** (14): Industrial Microbiology **BOT 3143** (10): Plant Ecology **BOT 3148** (10): Plant Systematics	NONE	**106**
	2	**MBY 3228** (14): Mycology and Phycology **MBY 3229** (14): Parasitology **BOT 3241** (10): Ethnobotany II **BOT 3246** (10): Plant Physiology **BOT 3247** (10): Plant Ecophysiology	NONE	

In year 1:
- Take modules in total of 8 credits from the elective module list
- Take either COM 0110 **OR** COM 0210

In year 2:
- Take modules in total of 20 credits from the elective module list

BSc (CHEMISTRY AND BIOCHEMISTRY) [CODE: MNBBSL]

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**CHE 1140** (16): General Chemistry for the Applied Sciences **MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematics Foundation I **BIO 1141** (16): The Tree of Life **BIO 1142** (16): Cell Biology **PHY 1125** (8): Physics for Natural Sciences I **COM 0110** (4): Computer Literacy **ECS 1141** (10): English Communication Skills (Generic Module)	NONE	**136**
	2	**CHE 1221** (8): Inorganic Chemistry I **CHE 1222** (8): Organic Chemistry I **MAT 1241** (8): Integral Calculus **MAT 1242** (8): Mathematics Foundation II **PHY 1225** (8): Physics for Natural Sciences II **COM 0210** (4): Computer Literacy **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	NONE	
Year 2 **NQF Level 6**	**1**	**BCM 2121** (10): Structural and functional Biochemistry I **BCM 2122** (10): Biochemical and Molecular Techniques **CHE 2121** (10): Inorganic Chemistry II **CHE 2122** (10): Organic Chemistry II **MBY 2121** (10): Bacteriology **MBY 2122** (10): Immunology	NONE	**120**
	2	**BCM 2221** (10): Structural and Functional Biochemistry II **BCM 2222** (10): Metabolism **CHE 2220** (10): Analytical Chemistry: Classical Techniques **CHE 2223** (10): Physical Chemistry I **MBY 2223** (10): Environmental Microbiology **MBY 2224** (10): Virology	NONE	
Year 3 **NQF Level 7**	**1**	**CHE 3120** (14): Analytical Chemistry: Instrumental Techniques **CHE 3123** (14): Physical Chemistry II **BCM 3121** (16): Protein Biochemistry **BCM 3122** (16): Advanced Molecular Techniques	NONE	**120**
	2	**CHE 3221** (14): Inorganic Chemistry III **CHE 3222** (14): Organic Chemistry III **BCM 3221** (16): Enzymology and Enzyme Biotechnology **BCM 3222** (16): Gene Expression, Protein Synthesis and Bioinformatics	NONE	

In year 1: Take either COM 0110 **OR** COM 0210

3.2.3. DESCRIPTION OF UNDERGRADUATE MODULES OFFERED BY THE DEPARTMENT OF BIOCHEMISTRY AND MICROBIOLOGY PER SEMESTER

SECOND YEAR MODULES – SEMESTER 1:

BCM 2121 : Structural and functional Biochemistry I [credits 10]
Pre-requisites : CHE 1140, CHE 1221, CHE 1222, BIO 1142
The chemistry of biomolecules (peptides, protein, vitamins, enzymes, co-enzymes), pH and buffers, bio-energetics

BCM 2122 : Biochemical and Molecular Techniques [credits 10]
Pre-requisites : CHE 1140, CHE 1221, CHE 1222, BIO 1142
Spectroscopy, Electrophoresis, Chromatography, Immunochemical techniques, Microscopy, cell Disruption Methods, Centrifugation, Protein Purification Methods and Introduction to Bioinformatics.

MBY 2121 : Bacteriology [credits 10]
Pre-requisites : BIO 1141, CHE 1140, CHE 1221 or CHE 1222
Historical perceptive of Microbiology. Characteristics of different groups of microorganisms. General structure of bacteria, functions of the different bacterial organelles, shapes of bacteria, Gram- positive and Gram- negative bacteria. Factors affecting bacterial growth and bacterial growth curve. Bacterial nutrition, metabolism and genetics. Mechanisms and modes of spread of bacterial infections. Staphylococci. Streptococci. Corynebacteria. Bacilli. Lactobacilli. Neisseria. Clostridia. The Enterobacteriaceae- Escherichia, Salmonella, Shigella, Campylobacter, Helicobacter. Vibrio, Klebsiella, Proteus, Yersinia. Aeromonas. Plesiomonas. Haemophilus. Mycobacterium tuberculosis. Mycobacterium leprae. Brucella. Bordetella. Rickettsiae. Mycoplasma. Coxiella. Treponemas. Bacterial chemotherapy. Seminars.

MBY 2122 : Immunology [credits 10]
Pre-requisites : BIO 1141, CHE 1140, CHE 1221 or CHE 1222
This module introduces the student to the basic concepts, components and functions of the vertebrate immune system: Innate immunity. Acquired immunity. Cells and tissues of the immune system. Classification. Structure and properties of antibodies, monoclonal antibodies. Concepts of antigen and antigenicity. Immunogen and immunogenicity. Haptens. AdjUnivenants. Human leucocyte antigens. Antigen-antibody reactions. Definitions of tolerance. Autoimmunity. Immunodeficiencies. Hypersensitivity and immunosuppression. Principles of immunization, EPA in South Africa. Immunotherapy, immunoprophylaxis. Bacterial/viral/parasitic/fungal immunity. Seminars reports.

SECOND YEAR MODULES – SEMESTER 2:

BCM 2221 : Structural and Functional Biochemistry II [credits 10]
Pre-requisites : CHE 1140, CHE 1221, CHE 1222, BIO 1142
Carbohydrates (classification, structure-function, configuration and conformation, derivatives of sugars, Structural Polysaccharides [Cellulose and Chitin], Storage Polysaccharides [Starch and Glycogen], Glycoproteins); *lipids and membranes* (classification [including sphingolipids and their roles in neurotransmission], structure-function, derivatives of lipids [including steroid hormones], lipoproteins); and *nucleic acids* (levels of structure in nucleic acids, DNA and RNA).

BCM 2222 : Metabolism [credits 10]
Pre-requisites : CHE 1140, CHE 1221, CHE 1222, BIO 1142
Carbohydrate metabolism; alternative routes of glucose metabolism; Krebs cycle, electron transport and oxidative phosphorylation, introduction to plant biochemistry and growth factors, lipid metabolism; amino acid metabolism, nucleic acid metabolism, xenobiotic metabolism [including cytochrome P450].

MBY 2223 : Environmental Microbiology [credits 10]
Pre-requisites : MBY 2121
Microorganisms in the various environments: viruses, bacteria, fungi, algae, protozoans, helminths. Soil classification, characteristics of microorganisms in the soil environment, Microbial activities in soil/soil borne pathogens. Role of microorganisms in nutrient/biogeochemical cycles- oxygen, water, carbon, nitrogen, sulphur. Mycorrhiza, lichens. Microbial interactions. Microorganisms in aquatic environment. Water and food borne pathogens. Indicator organisms. Domestic waste and waste treatment. Drinking water treatment and distribution. Microbiological Standards/criteria for water quality control. Airborne pathogens/toxins, bioaerosols and their control, microbial survival in the air. Beneficial and pathogenic microorganisms in Agriculture. Bioremedation. Biofilms. Microbial corrison/biofilms. Environental sample collection- specific methods for the isolation of pathogens from stools, food, water, air, soil. Introduction to molecular techniques. Pollution factors. Seminars/reports

MBY 2224 : **Virology [credits 10]**
Pre-requisites : MBY 2121
Nature and general characteristics of viruses: Structure and classification of viruses. Chemical composition of viruses. Viral susceptibility to chemical and physical agents/chemical composition of virus Cultivation of viruses/growth and detection of viruses in the laboratory. Viral cell interactions- lytic, steady and integrated State. Viral replication. Host responses to viral infections and outcome of viral infections. Viral genetics, viral interference and interferon. Some Virus infections: Hepatitis viruses, SARS virus infections, Herpes virus infections, Viral infections of the respiratory tract, alimentary tract, skin and mucous surfaces. Viral infections of the fetus and target organs. Measles, mumps, Rubella viruses. Enteroviruses. Influenzae and parainfluenza viruses. Ebola and Marburg viruses. Dengue fever and Lassa fever viruses. Rhabdovirus, Bacteriophages, viroids, virusoids and prions. Virus chemotherapy. Animal and plant viruses. Seminars

THIRD YEAR MODULES – SEMESTER 1:

Students are not allowed to proceed to do third year modules before clearing first year modules.

BCM 3121 : Protein Biochemistry [credits 16]
Pre-requisites : BCM2121, BCM2122, BCM2221, BCM2222
Structural organization of proteins, the concept of protein folding, protein structure and function, protein domains, intracellular signal transduction pathways (including neurotransmission biochemistry), role of proteins in transport

BCM 3122 : Advanced Molecular Techniques [credits 16]
Pre-requisites : BCM2121, BCM2122, BCM2221, BCM2222
LC-MS; biophysical techniques (ITC, circular dichroism, surface plasmon resonance, NMR, crystallography); flow cytometry; advanced electrophoresis; fluorescence; protein-protein interaction; advanced immuno-techniques; microarrays; RNA-interference and DNA sequencing.

MBY 3126 : Food Microbiology [credits 14]
Pre-requisites : MBY 2121, MBY 2223, MBY 2224
Roles and significance of microorganisms in food. Incidence and types of bacteria, molds and yeasts, viruses, parasites in meat, seafood and vegetables, dairy products, delicatessen and related products, frozen foods, dehydrated foods. Intrinsic and extrinisic parameters of food that affect microbial growth. Food Spoilage- fruit and vegetables, fresh and processed meat, poultry and seafood, dairy products, canned foods, beers/wines/fermented foods, sugars/candies. Food preservation- with chemical/irradiation, with low temperature/high temperatures, with drying/fermentation. Microbiological Standards and criteria for food safety. Guidelines for different foods (National and International). Indicators for food sanitary quality. Determination of microorganisms in food: culture sampling methods, microscopic method, physical methods, chemical methods, immunological methods, bioassay, cell culture system. Factors affecting microbial growth in food. Food borne infections and food intoxications- Aetiology, transmission, pathogenesis, epidemiology and control of food and water borne diseases. Quality assurance of food. Seminars/reports

MBY 3127 : **Industrial Microbiology [credits 14]**
Pre-requisites : MBY 2121, MBY 2223, MBY 2224
This module introduces students to the broad application of microorganisms in industrial processes: Essentials of DNA technology and genetic engineering: plasmids, transposons, plasmid DNA isolation, bacterial transformation and expression, polymerase chain reaction, restriction enzymes, electrophoretic techniques; biodiversity; economics of industrial processes; metabolism and regulation of metabolism; nutrient supply; application of microbes in the production of enzymes, alcoholic beverages, antibiotics, and proteins; concepts of biofilm, bioremediation, and microbial corrosion; plant biotechnology. Seminars/reports

THIRD YEAR MODULES – SEMESTER 2:

Students are not allowed to proceed to do third year modules before clearing first year modules.

BCM 3221 : Enzymology and Enzyme Biotechnology [credits 16]
Pre-requisites : BCM2121, BCM2122, BCM2221, BCM2222
Structure and function of enzymes, enzyme kinetics and mechanisms of enzyme catalyzed reactions, applications of enzyme technology (including industrial enzyme biotechnology).

BCM 3222 : Gene expression, Protein Synthesis and Bioinformatics [credits 16]
Pre-requisites : BCM2121, BCM2122, BCM2221, BCM2222
Central dogma, replication, transcription, translation, protein synthesis, protein targeting to subcellular organelles, post translational modification, protein degradation, nucleotide analogues [as mutagens and chemotherapeutic

agents], DNA damage and repair, recombinant DNA technology, gene therapy, DNA sequencing, introduction to genomics and proteomics, bioinformatics [blast, sequence alignment, major online genomic databases, homology modelling, predictive target ligand interactions, phylogeny].

MBY3228 : **Mycology and Phycology [credits 14]**
Pre-requisites : MBY 2121, MBY 2223, MBY 2224
Structure and features of fungi and algae. Classification of fungi: Zygomycetes, Basidomycetes, Ascomycetes, Deutromycetes, Yeasts, Lichens. Fungal cells growth and reproduction/life cycle. Role of fungi and algae in nature and human life: Fungal diseases of humans Fungal diseases of plants and animals. Importance of fungi in agriculture. Industrial uses of fungi. Mycorrhiza. Diagnosis of fungal infections. Mycotoxins. Antifungal agents. Seminars/reports.

MBY3229 : Parasitology [credits 14]
Pre-requisites : MBY 2121, MBY 2223, MBY 2224
Introduction to parasites. Classification of parasites. Structure and features of protozoan. Life cycle patterns of protozoan- Amoebae, Flagellates, Haemoflagellates, Ciliates, Sporozoa. Epidemiology, pathogenesis, symptoms, laboratory diagnosis, treatment, prevention and control of protozoa diseases. Classification of Helminths. General features/characteristics of helminthes. Life cycle patterns of helminthes. Epidemiology, pathogenesis, symptoms, laboratory diagnosis, treatment, prevention and control of - Trematodes, Cestodes and Nematodes infections. Host-parasite relationship/immune response to parasitic infections. Arthropds and Arthropod borne infections. Seminars/reports.

3.3 BACHELOR OF SCIENCE HONOURS DEGREE [BSc. Hons] OFFERED BY THE DEPARTMENT OF BIOCHEMISTRY AND MICROBIOLOGY

3.3.1 ADMISSION REQUIREMENTS

Qualification	Qualification Code	Duration	Admission Requirements
BSc Hons Biological Sciences (Biochemistry)	MNHHBC	1 year	• A candidate will be allowed to register for the Honours degree only if he/she possesses a BSc degree or equivalent or subject to SENATE approval, if he/she has completed the modules for a BSc degree, or if equivalent status has been conferred on him/her by SENATE. • Candidates must have passed the final-year modules of the subject in which they wish to study with an aggregate of 60%. Candidates with lower level passes may be accepted subject to SENATE approval. • Prospective candidate could be subjected to a final selection test which serves to assess their preparedness for the Honours course.
BSc Hons Microbiology	MNHSMH	1 year	• A candidate will be allowed to register for the Honours degree only if he/she possesses a BSc degree or equivalent or subject to SENATE approval, if he/she has completed the modules for a BSc degree, or if equivalent status has been conferred on him/her by SENATE. • Candidates must have passed the final-year modules of the subject in which they wish to study with an aggregate of 60%. Candidates with lower level passes may be accepted subject to SENATE approval. • Prospective candidate could be subjected to a final selection test which serves to assess their preparedness for the Honours course.

3.3.2 RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a)	The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture.
	(b)	The honours degree is offered over ONE academic year and students write examinations and present themselves for continuous assessment during the year of registration.
	(c)	**Project reports must be handed in before the 30th November of the academic year to graduate in the following May graduation.**

	(d)	Except with the special permission of SENATE, the duration of the full-time study **will not exceed TWO years**
	(e)	The degree will not be conferred on a candidate before at least one year has elapsed since he/she obtained the Bachelor's degree or another undergraduate degree as set out in the Faculty rules and unless he/she has been registered for one year at this University.
ASSESSMENT CRITERIA	(a)	Candidates will only be assessed in a specific module if they attended lectures, tutorials and prescribed practical satisfactorily and obtained a semester mark of at least 50%.
	(b)	A student **must** attain a minimum of 50% pass in **each** of the components of assessment. A student, who fails one of these components, will be allowed to repeat only that component. The written examination component will be conducted during the next normal examination period for that specific module.
	(c)	All written examinations will be taken only during official examination sessions**.**
	(d)	A candidate who fails two modules in the degree and obtains an aggregate of at least 50% may be admitted for assessment in those modules on one further sitting.
	(e)	To obtain the degree cum laude, a candidate must attain an aggregate of 75% or higher.
	(f)	To be awarded the BSc Hons degree, the candidate must accumulate at least 120 credits at this level.
	(g)	Special examinations **will not be offered** in the BSc Hons degree.
	(h)	An Aegrotat Examination may be granted to a student who has been prevented from sitting for the examination: • By illness on the day of the examination or assessment, or immediately before the examination or assessment, if a medical certificate from a registered medical practitioner is submitted to the Faculty, and/or if the student's application is supported by the invigilator concerned or another responsible person; or • Because of domestic circumstances such as serious illness or death of a close relative during the examination or assessment, or other reasons, if the Faculty judges it to be a bona fide case, and the student can provide satisfactory proof of such extraordinary circumstances.

3.3.3 BSC HONS: QUALIFICATIONS AND MODULE DESCRIPTIONS

BSc HONS BIOLOGICAL SCIENCES (BIOCHEMISTRY) [CODE: MNHHBC]

COMPULSORY SEMESTER 1 MODULES:	**COMPULSORY SEMESTER 2 MODULES:**
BCM 5123 [credits 12]: **Genomics, Proteomics and Bioinformatics**	**BCM 5222 [credits 12]:** **Research Techniques**
BCM 5125 [credits 12]: **Applied Biochemistry and Biotechnology**	**BCM 5223 [credits 12:** **Physiological Biochemistry and Cell Biology**
	BCM 5224 [credits 12]: **Protein Folding and Advanced Enzyme Kinetics**
COMPULSORY YEAR MODULES	
BCM 5300 [credits 45]: Research Project and Report	
BCM 5301 [credits 15]: Research Methods and Seminars	
Total Credits = 120	

BCM 5123 [credits 12]: Genomics, Proteomics and Bioinformatics
Genomics: Comparative and functional genomics (including at the host parasite interface); genome sequence acquisition; mutations and their consequences; epigenetics; biomedical genome research; gene mapping (including ESTs, SNPs, pseudogenes, transposable elements); DNA microarrays and chemotherapy; recombinant DNA technology; applications of recombinant DNA;
Proteomics: protein interaction networks; post translational modifications; various approaches to proteomic studies.

BCM 5125 [credits 12]: Applied Biochemistry and Biotechnology
Applied aspects of basic biological sciences and how to develop an innovative approach to science in general; recombinant DNA technology and synthetic biology (with respect to its application in the production of novel products such as antibiotics, biopolymers, enzymes, unnatural amino acids and nucleotides; and its application in the technologies such biosensors, industrial enzymes); protein folding and engineering; bioreactors (biofuels production as case study); nanobiotechnology (with respect to application in bio-distribution, nano-drug delivery, bio-imaging).

BCM 5222 [credits 12]: Research Techniques
Hands-on applications of various advanced biochemical research techniques with emphasis on: extraction and purification of biomolecules; ultrasonication and ultracentrifugation; 2DGE; spectrometric methods (including SEC, fluorimetry, UV-Vis, CD-, FTIR, and MS- spectrometric); microscopic methods (fluorescence, SEM, TEM, HRTEM); NMR; FACS; microarrays; biomolecular interaction studies (including slot blot, far-Western, SPR, pull-down assays).

BCM 5223 [credits 12]: Physiological Biochemistry and Cell Biology
Cell structure and function (prokaryotes and eukaryotes); replication and cell division; cancer biology; signal transduction; biogenesis of proteins and targeting; microtubules; cell motility; membrane trafficking; endocytosis and exocytosis; compartment and sorting; nutrient malabsorption and drug metabolism.

BCM 5224 [credits 12]: Protein Folding and Advanced Enzyme Kinetics
The concept of protein folding; molecular chaperones; protein misfolding diseases; protein quality control; advanced enzyme kinetics and mechanistic abilities of enzymes; non-protein biocatalysis; catalytic nucleic acids; regulation; allosteric enzymes; covalent modifications for enzyme regulation; co-factors; vitamin essential metals; zymogens; practical applications of enzymes as biological catalysts in industrial processes.

BCM 5300 [credits 45]: Research Project and Report
Students design and execute a research project. They learn to plan and structure appropriate experimental approaches to achieve particular aims of their projects. They finally compile a scientific report (mini-dissertation).The project is written up in a formal document comprising: Introduction/Background, Aims (objectives), Materials and Methods, Results, Discussion, Conclusions and recommendations.

BCM 5301 [credits 15]: Research Methods and Seminars
Research planning, data handling and scientific writing; presentation of research proposal and research progress (seminars); analysis of biochemistry research publications are conducted towards developing critical understanding (journal club). Ethical and philosophical issues in biochemistry research are addressed.

BSc HONS MICROBIOLOGY [CODE: MNHSMH]

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
MBY 5102 [credits 15]: **Advanced Immunological Concepts and Techniques**	**MBY 5204 [credits 15]: The Role of Microorganisms in Industrial Processes**
MBY 5103 [credits 15]: The Role of Microorganisms in Disease	**MBY 5205 [credits 15]: The Role of Microorganisms in the Environment**
COMPULSORY YEAR MODULES	
MBY 5300 [credits 30]: Research Project and Report	
MBY 5301 [credits 30]: Advanced Research Methodology and Seminars	
Total Credits = 120	

MBY 5102 [credits 15]: **Advanced Immunological Concepts and Techniques**
Overview of the vertebrate immune system; production and use of monoclonal antibodies; tolerance induction; immunosuppresion; immunodeficiencies; autoimmunity, hypersensitivity reactions; blood transfusion and transplantation immunology; applications of agglutination, precipitation, complement system and human leucocyte antigen-MHC; enzyme immunoassays; immunofluorescence microscopy; flow cytometry; nucleic acid isolation; reverse transcriptase, multiplex and real-time PCR; endonuclease digest analysis; DNA sequencing, editing and bioinformatics; viral infectivity assays; vaccine design, development and evaluation.

MBY 5103 [credits 15]: The Role of Microorganisms in Disease
Epidemiology, transmission, pathogenesis, clinical presentations, diagnosis, treatment and prevention and control of common bacterial, viral, fungal and parasitic diseases including: Staphylococcal and streptococcal diseases, anthrax, brucellosis, diarrhea/dysentery, gonococcal and meningococcal infections, syphilis, tuberculosis and leprosy, meningitis, whooping cough, diphtheria, clostridial infections, HIV, viral hepatitis, entero- virus diseases, yellow fever, herpes virus, measles infections, CMV and EBV infections, HPV infections, Lassa fever, Ebola, influenza viral infections, other haemorrhagic fever virus. amoebiasis, giardiasis, trichomoniasis, trypanasomiasis, leishimaniasis, malaria, cryptosporidiosis, schistosomiasis, hookworm, ascariasis, taeniasis, enterobiasis, onchocerciasis/loasis, dracunculosis, pneumocystis infection and other parasitic diseases, cryptococcosis, histoplasmosis, blastomycosis, candidiasis, aspergillosis, ptyiriasis versicolor, scaly cutaneous mycosis, and cutaneous fungal infections. Prions

MBY 5204 [credits 15]: The Role of Microorganisms in Industrial Processes
Gene loss, amplification and arrangement; lac and galactose operons; gene library; recombination and screening; sequencing; restriction fragment length polymorphism analysis and related techniques; restriction mapping; plant biotechnology; fermentation systems; production of antibiotics and antibiotic sensitivity assays. Application of bacteria and fungi in industry. Quality control and quality assurance; intellectual property rights.

MBY 5205 [credits 15]: The Role of Microorganisms in the Environment
Advanced lecture on different microbes in the environment- soil, aquatic environment, air. Beneficial and pathogenic microorganisms in agriculture. Water and food borne pathogens- bacteria, fungi, parasites. Advanced lecture on indicator organisms. Biogeochemical cycles: (water, carbon, nitrogen, Sulphur, iron, phosphorous, oxygen). Bioremediation, biofilm formation and significance in bioremediation, corrosion, and disease. Environmental sample collection and identification of organisms. Water treatment- chlorination, chloramination, ozonation, irradiation. Domestic water treatment.

MBY 5300 [credits 30]: Research Project and Report
Students design and execute a research project. They learn to plan and structure appropriate experimental approaches to achieve particular aims of their projects. They finally compile a scientific report (mini-dissertation).The project is written up in a formal document comprising: Introduction/Background, Aims (objectives), Materials and Methods, Results, Discussion, Conclusions and recommendations.

MBY 5301 [credits 30]: Advanced Research Methodology and Seminars
Research methodology. Preparation of research proposal. Art of scientific writing. Poster presentation. Oral presentation. Statistical methods. Seminars

3.4. MASTERS (MSc) QUALIFICATIONS OFFERED IN THE DEPARTMENT OF BIOCHEMISTRY AND MICROBIOLOGY IS ONLY BY RESEARCH

3.4.1 ADMISSION REQUIREMENTS

Qualification	Qualification Code	Period	Admission Requirements
MSc Biochemistry	MNMMSB [Project: BCM 6300]	2 years	• A 4 years Bachelor degree or Honours degree in Biochemistry with an average of 65%, an upper-second class for a class-based system with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.
MSc Microbiology	MNMMMS [Project: MBY 6300]	2 Years	• A 4 years Bachelor degree or Honours degree in Microbiology with an average of 65%, an upper-second class for a class-based system with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

3.4 2. RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title and topic of the proposed dissertation, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and the Faculty Higher Degrees Committee final approval. (b) The Research proposal, registration and ethics must be approved by the Deprtments Higher Degrees Committee and then send for final approval to the Faculty Higher Degrees Committee and UHDC. (c) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the Master's degree may be conferred only after the candidate has been registered for a period of at least TWO years fulltime. (d) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE. (e) The Research MSc degree is conferred based on a dissertation and an examination, or a dissertation only, as determined by the Faculty Academic Board. (f) The taught MSc degree is conferred based on a mini dissertation and a component of taught modules which must all be passed as per degree requirements (g) The Head of Department may prescribe certain ancillary modules which must be enrolled or passed before the date of the Master's examination. (h) The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture. (i) SENATE may, at any time, suspend or cancel the registration of any student who, in its view, is not making satisfactory progress. (j) Students who wish to defer their studies at **any stage MUST APPLY** to the relevant department. If granted, such deferment will be for **a maximum period of one year**, after which a further application must be submitted. Deferment will, **at most**, be granted twice. (k) Before registration for 2nd or further years, the student must write a full progress report for the year passed which is signed by the supervisor and the HOD to show progress, which will be approved /not approved by the Executive Dean. This progress report will count as the last quarterly report of the passed year for the student. **No** student will be allowed to register without the approval of the Executive Dean
ASSESSMENT CRITERIA	(a) Procedures as per post-graduate policies and guidelines will be followed – this includes the agreement between the student and supervisor that must be in placed as well as the quarterly reports that must be send to the Faculty Research office as proof of student's progress (b) Quarterly progress reports are compulsory

3.5 DOCTORAL QUALIFICATIONS OFFERED BY THE DEPARTMENT OF BIOCHEMISTRY AND MICROBIOLOGY IS ONLY BY RESEARCH

3.5.1 ADMISSION REQUIREMENTS

Qualification	Qualification Code	Period	Admission Requirements
PhD Biochemistry	MNPDPB [Project: BCM 7300]	3 years	• A MSc in Biochemistry with a minimum mark of 65% OR equivalent status conferred by SENATE • Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the Department's Higher Degrees Committee concerned for recommendation to the School's Higher Degree's committee and University higher degree's committee and approval by SENATE. The Research proposal must be approved by the • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.
PhD Life Sciences (Microbiology)	MNPLSM	3 years	• A MSc in Microbiology with a minimum mark of 65% OR equivalent status conferred by SENATE

	[Project: MBY 7300]		• Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the Department's Higher Degrees Committee concerned for recommendation to the School's Higher Degree's committee and University higher degree's committee and approval by SENATE. The Research proposal must be approved by the • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

3.5.2 RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title and topic of the proposed thesis, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and then the Faculty Higher Degrees Committee for approval. (b) The Research proposal, registration of project and ethics application must be approved by the Departments and Faculty's Higher Degrees Committee before final approval by the UHDC. (c) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the degree may be conferred only after the candidate has been registered for a period of at least THREE years fulltime. (d) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE.
ASSESSMENT CRITERIA	(a) Procedures as per Postgraduate policy guidelines will be followed. This will include the agreement between the supervisor and the doctoral student and the quarterly progress reports that must be submitted in time to the Faculty Research office (b) External examination of thesis will be done as per Post Graduate policies (c) Viva Voce as per school postgraduate guidelines through the office of the Executive Dean. If a student fails the Viva Voce, the degree will not be awarded. (d) Quarterly progress reports are compulsory

SECTION 4:

DEPARTMENT: BIOLOGICAL SCIENCES

4.1. QUALIFICATIONS OFFERED BY THE DEPARTMENT OF BIOLOGICAL SCIENCES

Diploma in Fresh water Technology

- DIPLOMA (FRESHWATER TECHNOLOGY) CODE: MNDDFT

Generic BSc degrees (BSc):

- BSc (BIOCHEMISTRY AND BIOLOGY) CODE: MNBBSD
- BSc (MICROBIOLOGY AND BOTANY) CODE: MNBBSE
- BSc (BOTANY AND ZOOLOGY) CODE: MNBBSO

BSc Hons degrees (BSc.Hons)

- BSc HONS BIOLOGICAL SCIENCES (BOTANY) CODE: MNHHBT
- BSc HONS BIOLOGICAL SCIENCES (ZOOLOGY) CODE: MNHHZO

MSc degrees (MSc):

- MSc BIOLOGICAL SCIENCES (BOTANY) Project: BOT 6300 CODE: MNMBSB
- MSc BIOLOGICAL SCIENCES (ZOOLOGY) Project: ZOO 6300 CODE: MNMBSZ

PhD degrees (PhD):

- PhD LIFE SCIENCES (BOTANY) Project: BOT 7300 CODE: MNPLSB
- PhD LIFE SCIENCES (ZOOLOGY) Project: ZOO 7300 CODE: MNPLSZ

4.2. DIPLOMA IN FRESHWATER TECHNOLOGY

4.2.1 ADMISSIONS REQUIREMENTS, RULES FOR PREGRESSION AND ASSESSMENT CRITERIA FOR THE DIPLOMA IN FRESHWATER TECHNOLOGY

ADMISSIONS REQUIREMENTS	(a) A national Senior Certificate with a minimum of 30% in the language of learning coupled with an achievement rating of 3 (Moderate Achievement, 40 – 49%) or better in four of the recognized 20-credit NSC subjects and a 4 in either Biology, Agricultural Sciences, Physical Sciences or Geography.
RULES FOR PROGRESSION	(a) The Diploma in Freshwater Technology is a three-year full time qualification. (b) To obtain the Diploma in Freshwater Technology from the School, students must have earned at least 360 credits including all core and fundamental modules. (c) To complete the three-year diploma, students are required to enroll for at least 120 credits per year. (d) For a student to progress to the third-year level, a student must have passed **ALL** first- and second-year modules. (e) Modules are offered as block teaching that consist of six teaching blocks of 9 days in each year of study. In addition, two block practical work will be included in the first year of study. The first block is in January prior to the start of graduate lectures.
ASSESSMENT CRITERIA	(a) Assessment in the project-based modules of the second and third year of the Diploma in Freshwater Technology (FWT 2201, FWT 2202, FWT 3201 and FWT 3202) will not include a formal exam but students will be assessed through project portfolios that **must be submitted** for assessment. (b) The third-year module assessments will include the submission and assessment of a report completed by the appointed supervisor of the institution where the candidate had completed an industrial placement that forms part of the Work Integrated Learning (WIL) component of the diploma.

4.2.2. DIPLOMA (FRESHWATER TECHNOLOGY) [CODE: MNDDFT]

YEAR	SEMESTER	COMPULSORY MODULES	CREDITS
Year 1	**1**	**BIO 1143** (16): Diversity of Life for diploma students **BIO 1144** (16): Cell Biology for diploma students **FWT 1141** (16): Introductory biometry **HWR 1141** (10): Introductory Hydrology and Meteorology	**120**
	2	**BIO 1245** (16): Ecology, Adaptation and Evolution for diploma students **FWT 1241** (16): Introduction to Fluvial Geomorphology and the Physico-chemical aspects of Water **FWT 1201** (28): An Introduction into Research Methodology and Project Planning and Project Management **COM 0210** (4): Computer Literacy	
Year 2	**1**	**FWT 2131** (20): Basic Freshwater Ecology **FWT 2132** (20): Freshwater Biology **FWT 2133** (20): Identification of Freshwater Organisms	**120**
	2	**FWT 2201** (30): Aquatic Habitat Delineation and Classification (Project) **FWT 2202** (30): Collection and Identification of Freshwater Organisms (Project)	
Year 3	**1**	**FWT 3131** (20): Sampling Technology **FWT 3132** (20): Introduction to Water Resource Management **FWT 3133** (20): Biomonitoring Technology	**120**
	2	**FWT 3201** (30): Sampling in Freshwater Ecosystems (Project) **FWT 3202** (30): Biomonitoring of Freshwater Ecosystems (Project)	

4.2.3. MODULES OFFERED IN THE DIPLOMA (FRESHWATER TECHNOLOGY) PER SEMESTER

FIRST YEAR MODULES: - FIRST SEMESTER

BIO 1143: Diversity of Life for Diploma Students [credits 16]

This module will focus on:

a) Origin of microbiology: Introduction to bacteria, fungi, protista and viruses.
b) Control of microorganisms: Immunity and infection.
c) Taxonomic classification concepts and rules.
d) Introduction to microscopy.
e) Survey of the diversity of organism groups.
f) Review of the animal kingdom.
g) Review of the plant kingdom.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%).
b) Examination: The examination for this module consists of 1 three-hour paper.

BIO 1144: **Cell Biology for Diploma Students [credits 16]**

This module will focus on:

a) Organic chemistry: The scope of biochemistry, Organic compounds of importance to the living system (The structure, functional groups, stereo-chemistry and characteristics of the carbohydrates, lipids, proteins and nucleic acids), The chemical-physical principles of biochemical bonds, The matrix of life: weak interactions in an aqueous solution, The energetics of life.
b) Cytology: The history of cell biology, the cell theory, Membrane biology, the structure and feature of eukaryotic cells, Techniques used in cytology, Prokaryotic cells.

c) Genetics: DNA replication, Transcription and translation, introductory principles of mitosis and meiosis, Chromosome variation, sex determination and the mechanism of sex related inheritance, Mendelian genetics.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%).
b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 1141: **Introductory Biometry [credits 16]**

This module will focus on:

(a) Introduction to the basis of Biometry and Statistics for biology students.
(b) Introduction to Descriptive statistics, Inferential statistics, Comparative statistics, Association statistics, and frequency statistics, and Probability and Probability Distributions.
(c) Introduction to Forecasting and Time-Series Analysis and Estimation.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%).
b) Examination: The examination for this module consists of 1 three-hour paper.

HWR 1141: **Introductory Hydrology and Meteorology [credits 10]**

This module will focus on:

Definition and scope of hydrology as an area of study; the hydrologic cycle; energy transformations and the water budget equation; the catchment and human interference; precipitation as a process; types of precipitation; artificially induced precipitation; measurement of precipitation; effective depth of precipitation; potential and actual evapo-transpiration and their measurements; factors influencing evaporation; increased water supplies through reduced evaporation; the runoff process; measurement of stream flow; the infiltration process; soil moisture, moisture storage and measurement; factors and elements of climate; impact of people on climate and the influence of climate on historical events; the atmosphere, its structure and composition; radiation, temperature, pressure, wind, humidity, precipitation, clouds, air masses and fronts; measurements; weather maps.

FIRST YEAR MODULES: - SECOND SEMESTER

BIO 1245: **Ecology, Adaptation and Evolution for Diploma Students [credits 16]**

This module will focus on:

a) Ecosystems. Energy flow and nutrient cycling.
b) Analysis of communities, ecological hierarchy and sampling methodology.
c) Species area relationship.
d) Latitudinal gradient. Common and rare species.
e) Interactive networks and food webs. Niches and competition. Predation and disturbance.
f) Demography. Dispersal. Darwinism.
g) Microevolution and Macroevolution.
h) Adaptation.
i) History of life on earth.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%)
b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 1241: Introduction to Fluvial Geomorphology and the Physico-Chemical aspects of Water [credits 16]

This module will focus on:

a) Fluvial geomorphology: The concept of fluvial geomorphology. Linking the river channel to the catchment and the concept of landscape connectivity. The geomorphological classification and zonation of rivers. Drivers of rivers systems.

b) Water: The water molecule, the hydrological cycle, acids bases and buffers, gasses dissolved in water, the electrical conductivity of water, light, temperature, sediments, turbidity, suspended solids, dissolved substances and nutrients in water.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

a) Semester mark: The semester mark will consist of a test mark (80%) derived from formal tests and an assignment mark (20%)
b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 1201: **An introduction into Research Methodology, Project Planning and Project Management [credits 28]**

This module will focus on:

a) The "Scientific Method" which *inter alia* includes problem identification, the setting of a research question, drawing up a hypothesis and defining the aims and objectives.
b) The project planning will include time and resource management. As part of project management component, the student will be introduced to management concepts, approaches and applications.
c) The theory will include case studies, and this will be backed up by the students planning research projects regarding hypothetical problems.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

a) Semester mark: The semester mark will consist of a test mark (80%) derived from formal tests and an assignment mark (20%)
b) Examination: The examination for this module consists of 1 three-hour paper.

COM 0210: **Computer Literacy [credits 4]**

Computer architecture and the human-computer interface. Operating systems and programming languages. Basic drawing and word-processing, Using statistical and introduction to database management systems. Networks: communication and information resources on the Internet.

SECOND YEAR MODULES – FIRST SEMESTER:

FWT 2131: **Basic Freshwater Ecology [credits 20]**

Pre-requisites: FWT 1141, FWT 1241, BIO 1143, BIO 1144, BIO 1245, HWR 1141

This module will focus on:

a) Defining limnology and introducing the relevant ecological concepts. Classification of water bodies.
b) General introduction to Wetlands (definition, classification, functioning), Lentic water bodies (definition, origin, classification functioning, and zonation) and Lotic water bodies (the river continuum concept, zoning, reaches and habitats).
c) The physico-chemical character of water bodies. Primary and secondary production and the cycling of nutrients and energy.
d) The impacts of damming, alien invasive organisms, pollution and eutrophication on river systems.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%)
b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 2132: **Freshwater Biology [credits 20]**

Pre-requisites: BIO 1143, BIO 1144, BIO 1245, FWT1141, FWT 1241, HWR 1141

This module will focus on:

a) Bacteria in freshwater. Freshwater algae and their role in the aquatic environment.
b) The structure and function of plant and animal communities of rivers and wetlands.
c) Review of the biology of the crustaceans, aquatic insects and freshwater fish.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%)
b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 2133: **Identification of Freshwater Organisms [credits 20]**
Pre-requisites: *BIO 1143, BIO 1144, BIO 1245, FWT1141, FWT 1241, HWR 1141*
This module will focus on:
a) The role played by morphological characteristics in the identification of organisms.
b) The use of keys and identification guides.
c) The identification of microscopic organisms (algae and diatoms).
d) The identification of aquatic macroinvertebrates.
e) The identification of aquatic macrophytes with an emphasis on aquatic weeds and alien invasive organisms.
f) The identification of freshwater fish.
Assessment:
The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.
a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%)
b) Examination: The examination for this module consists of 1 three-hour paper.

SECOND YEAR MODULES – SECOND SEMESTER:

FWT 2201: **Aquatic Habitat Delineation and Classification (Project) [credits 30]**
Pre-requisites: *COM 0210, FWT 1201, FWT 2131, FWT2132, FWT 2133*
This module will focus on:
a) Identifying, delineate and classify wetlands.
b) Identify and delineate habitat types in lotic systems and their related riparian zones.
Assessment:
The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.
a) Semester mark: The semester mark is obtained from the portfolio which contains the project proposals for two practical projects.
b) Examination: There is no formal written examination for this module and this mark will be based on a portfolio which contains the reports on two projects.

FWT 2202: **Collection and Identification of Freshwater Organisms (Project) [credits 30]**
Pre-requisites: *COM 0210, FWT 1201, FWT 2131, FWT 2132, FWT 2133*
This module will focus on:
a) applying the collection/sampling and identification methods to identified wetlands.
Assessment:
The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.
a) Semester mark: The semester mark is obtained from the portfolio which contains the project proposals for two practical projects.
b) Examination: There is no formal written examination for this module and this mark will be based on a portfolio which contains the reports on two projects.

THIRD YEAR MODULES – FIRST SEMESTER:

Students are not allowed to proceed to do third year modules before successfully completing all first- and second-year modules.

FWT 3131: **Sampling Technology [credits 20]**
Pre-requisites: *FWT 2131, FWT 2132, FWT 2133*
This module will focus on:
a) For water quality determination: The purpose of water quality, monitoring. Sampling design. Measurement of the physical properties of water (DO, temperature, pH, conductivity, Turbidity, Light penetration).
b) Sampling techniques of water sediment and fish for chemical analyses (major inorganic ions, heavy and trace metals, organic compounds).
c) Sampling techniques for biological and bacteriological analyses.
d) Sampling techniques for toxicity testing. Early detection and eradication of alien invasive plants.

e) Introduction and practical use of relevant apparatus.
f) Sampling and preservation techniques of biological samples (algae/diatoms/plants/insects/fish).
g) The role of voucher specimens and other specimens for future reference.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%)
b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 3132: **Introduction to Water Resource Management [credits 20]**

Pre-requisites: *FWT 2131, FWT 2132, FWT 2133*

This module will focus on:

a) Basic principles of management and sustainable development.
b) Sustainable development and management of water resources.
c) The principles and application of water and sewage treatment.
d) Control of invasive plants and animals.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests and an assignment mark (10%) and a practical mark (20%)
b) Examination: The examination for this module consists of 1 three-hour paper.

FWT 3133: **Biomonitoring Technology [credits 20]**

Pre-requisites: *FWT 2131, FWT 2132, FWT 2133*

This module will focus on:

a) Reasons for biomonitoring. The history and development of biomonitoring.
b) EcoStatus and Ecological Reserve determination.
c) Planning of a biomonitoring exercise.
d) Introduction to indices currently in use in South Africa (FRAI, VEGRAI, IHI, MIRAI and SASS).

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

a) Semester mark: The semester mark will consist of a test mark (70%) derived from formal tests, an assignment mark (10%) and a practical mark (20%)
b) Examination: The examination for this module consists of 1 three-hour paper.

THIRD YEAR MODULES – SECOND SEMESTER:

FWT 3201: **Sampling in Freshwater Ecosystems (Project) [credits 30]**

Pre-requisites: *FWT 2201, FWT 2202, FWT 3131, FWT 3132, FWT 3133*

This module will focus on:

a) Students will be assigned a river/wetland for which they have to set up a sampling protocol (for repeated sampling for four weeks).
b) Submission of a project proposal.
c) Give a presentation of the project proposal.
d) Perform in situ physico-chemical determinations, collect samples for major inorganic ion analyses
e) Write a report on the in-situ findings.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

a) Semester mark: The semester mark is obtained from
    - The portfolio which contains the project proposals (70%)
    - Evaluation of an oral presentation of project plan (10%)
    - Report from WIL project mentor (20%)
b) Examination: There is no formal written examination for this module and this mark will be based on a portfolio which contains the project reports.

FWT 3202: **Biomonitoring of Freshwater Ecosystems (Project) [credits 30]**

Pre-requisites: FWT 2201, FWT 2202, FWT 3131, FWT 3132, FWT 3133

This module will focus on:

a) Students will be assigned a river for which they have to assess the Eco-status using currently applicable biomonitoring indices such as IHI and SASS5.
b) Submission of a project proposal.
c) Give a presentation of the project proposal.
d) Apply the relevant indices.
e) Write a report on the findings.

Assessment:

The promotion mark of this module consists of a combination of the semester mark (60%) and the examination mark (40%). To qualify for the exam a minimum semester mark of 40% is required.

(a) Semester mark: The semester mark is obtained from
- The portfolio which contains the project proposals (70%)
- Evaluation of an oral presentation of project results (10%)
- Report from industrial partner mentor (20%)

(b) Examination: There is no formal written examination for this module and this mark will be based on a portfolio which contains the project reports

4.3. GENERIC BSc QUALIFICATION OFFERED IN THE DEPARTMENT OF BIOLOGICAL SCIENCES [CREDITS = 360]

4.3.1. ADMISSION REQUIREMENTS, RULES FRO PROGRESSION AND ASSESSMENT CRITERIA

ADMISSIONS REQUIREMENTS	(a) Candidates wishing to enroll for a Generic BSc degree in the Department of Biological Sciences in any of the undergraduate qualifications listed, must have obtained a minimum admission requirement in a National Senior Certificate (NSC) as certified by the Council for General and Further Education and Training (Umalusi) with an achievement rating of **4** (adequate achievement, 50-59%) or better in **each** of the following four recognised 20-credit NSC subjects: • English • Mathematics • Physical Science • Life Sciences (b) Any other related subject as judged by the HOD of the responsible department and approved by the Executive Dean of the Faculty (c) Candidates may be subjected to a selection procedure as determined by the Faculty board. (d) Equivalent FET Level 4 qualifications in any of the above subjects may also be considered. (e) Students from the Extended BSc Degree Programme should have obtained 120 credits from the 12 modules registered for, before admission to the listed mainstream degree.
RULES FOR PROGRESSION	**Students from the foundation year:** (a) All outstanding Foundation year modules **must be** registered for and passed during year 2 of the extended programme. (b) Students will not be allowed to move to year 3 of the extended programme or take any second-year mainstream modules if they still have **outstanding extended/foundation 1st year modules**. (c) A third-year extended programme student who has passed 60% of his/her second-year modules **may only** register third year modules whose Pre-requisites have been met, subject to the approval of the Head of Department and the Executive Dean. (d) Students may not select modules that clash on the lecturing and practical timetables. (e) No curriculum change, whether within or from outside the Faculty, will be recognized unless approved by the Executive Dean. (f) A full-time student may take a maximum of 32 credits over and above the minimum 360 credits required for the degree, **subject to the approval of the Head of Department and the Executive Dean**. (g) Students can register ONLY for modules for which **ALL** pre-requisites have been satisfied. (h) Students retain credits for all modules passed. (i) To qualify for a BSc degree in the Faculty, students must obtain a minimum of half of their credits in a learning stream within the Faculty of Sciene, Engineering and Agriculture.

	<u>Students registered for 3 year BSc degree:</u> (a) A student **<u>may only progress to the second-year level</u>** when she/he has passed 60% of the 1st year modules in the mainstream BSc degree (b) To progress to the third-year level, a student must have passed **<u>ALL</u>** first- and second-year modules. (c) Students may not select modules that clash on the lecturing and practical timetables. (d) No curriculum change, whether within or from outside the Faculty, will be recognized unless approved by the HOD and the Executive Dean. (e) A full-time student may take a maximum of 32 credits over and above the minimum 360 credits required for the degree, **<u>subject to the approval</u>** of the Head of Department and the Executive Dean. (f) Students can register **<u>ONLY</u>** for modules for which **<u>ALL</u>** Pre-requisites have been satisfied**.** (g) Students retain credits for all modules passed. (h) To qualify for a BSc degree in the School of Mathematical and Natural Sciences, students **<u>must obtain a minimum</u>** of half of their credits in a learning stream within this School. (i) To obtain a degree from the School, students must have earned at least 360 credits including all core and fundamental modules in one of the generic Bachelor of Science qualifications. Departments may prescribe additional credits **<u>provided these do not exceed</u>** 32 credits. (j) The minimum registration period for a BSc. degree is three years and the maximum is n+2.
ASSESSMENT CRITERIA	(a) Continuous Assessment will be determined by the Department and approved by the Faculty Board and consist of tests, practical sessions and tests, tutorials, projects, assignments and reports. (b) Students will write examinations at the end of each semester on condition that they qualify to do so. (c) The minimum final pass mark in any module is 50%. (d) To obtain the degree or diploma cum laude, a candidate must attain an aggregate of 75% or higher.

4.3.2. THE BSc QUALIFICATIONS OFFERED IN THE DEPARTMENT OF BIOLOGICAL SCIENCES

BSc (BIOCHEMISTRY AND BIOLOGY) **[CODE: MNBBSD]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**CHE 1140** (16): General Chemistry for the Applied Sciences **BIO 1141** (16): The Tree of Life **BIO 1142** (16): Cell Biology **MAT 1143** (8): Mathematics for Biological, Earth and Life Sciences I **COM 0110** (4): Computer Literacy **ECS 1141** (10): English Communication Skills (Generic Module)	**PHY 1125** (8): Physics for Natural Sciences I **STA 1149** (8): Basic Statistics (for the Natural and Applied Sciences)	**120**
	2	**CHE 1221** (8): Inorganic Chemistry I **CHE 1222** (8): Organic Chemistry I **BIO 1243** (16): Ecology, Adaptation and Evolution **COM 0210** (4): Computer Literacy **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**MAT 1243** (8): Mathematics for Biological, Earth and Life Sciences II **PHY 1225** (8): Physics for Natural Sciences II **STA 1249** (8): Basic Statistical Inference (for the Natural and Applied Sciences)	
Year 2 **NQF Level 6**	**1**	**BCM 2121** (10): Structural and Functional Biochemistry I **BCM 2122** (10): Biochemical and Molecular Techniques **BOT 2144** (16): Plant Anatomy and Morphology **ZOO 2141** (16): Animal Physiology **ZOO 2144** (16): Principles of Genetics	NONE	**136**
	2	**BCM 2221**(10): Structural and Functional Biochemistry II **BCM 2222** (10): Metabolism **BOT 2245** (16): Plant Taxonomy and Reproductive Biology I **BOT 2249** (16): Ethnobotany I **ZOO 2248** (16): Animal Phylogeny	NONE	
Year 3 **NQF Level 7**	**1**	**BCM 3121** (16): Protein Biochemistry **BOT 3148** (10): Plant Systematics **ZOO 3141** (16): Animal Ecophysiology	**BCM 3122** (16): Advanced Molecular Techniques	**104**
	2	**BCM 3221** (16): Enzymology and Enzyme Biotechnology **BOT 3246** (10): Plant Physiology **ZOO 3249** (20): Evolutionary Genetics	**BCM 3222** (16): Gene Expression, Protein Synthesis and Bioinformatics **BOT 3241** (10): Ethnobotany II **BOT 3247** (10): Plant Ecophysiology	

In year 1:
- Take modules in total of 8 credits from the elective module list
- Take either COM 0110 **OR** COM 0210

In year 3:
- Take modules in total of 16 credits from the elective module list

BSc (MICROBIOLOGY AND BOTANY) [CODE: MNBBSE]

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**CHE 1140** (16): General Chemistry for the Applied Sciences **BIO 1141** (16): The Tree of Life **BIO 1142** (16): Cell Biology **MAT 1143** (8): Math for Biological, Earth and Life Sciences I **STA 1149** (8): Basic Statistics (for the Natural and Applied Sciences) **COM 0110** (4): Computer Literacy **ECS 1145** (10): English Communication Skills	**PHY 1125** (8): Physics for Natural Sciences I	**136**
	2	**CHE 1221** (8): Inorganic Chemistry 1 **CHE 1222** (8): Organic Chemistry 1 **STA 1249** (8): Basic Statistical Inference (for the Natural and Applied Sciences) **BIO 1243** (16): Ecology, Adaptation and Evolution **COM 0210** (4): Computer Literacy **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**MAT 1243** (8): Math for Biology, Earth and Life Sciences II **PHY 1225** (8): Physics for Natural Sciences II	
Year 2 **NQF Level 6**	**1**	**MBY 2121** (10): Bacteriology **MBY 2122** (10): Immunology **BOT 2144** (16): Plant Anatomy and Morphology **BIO 2142** (16): Population Ecology	**CHE 2121** (10): Inorganic Chemistry II **CHE 2122** (10): Organic Chemistry II	**118**
	2	**MBY 2223** (10): Environmental Microbiology **MBY 2224** (10): Virology **BOT 2245** (16): Plant Taxonomy and Reproductive Biology **BOT 2249** (16): Ethnobotany I	**ZOO 2248** (16): Animal Phylogeny **CHE 2220** (10): Analytical Chemistry: Classical Techniques **CHE 2223** (10): Physical Chemistry I	
Year 3 **NQF Level 7**	**1**	**MBY 3126** (14): Food Microbiology **MBY 3127** (14): Industrial Microbiology **BOT 3143** (10): Plant Ecology **BOT 3148** (10): Plant Systematics	NONE	**106**
	2	**MBY 3228** (14): Mycology and Phycology **MBY 3229** (14): Parasitology **BOT 3241** (10): Ethnobotany II **BOT 3246** (10): Plant Physiology **BOT 3247** (10): Plant Ecophysiology	NONE	

In year 1:
- Take modules in total of 8 credits from the elective module list
- Take either COM 0110 **OR** COM 0210

In year 2:
- Take modules in total of 20 credits from the elective module list

BSc BOTANY AND ZOOLOGY **[CODE: MNBBSO]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**BIO 1141** (16): The Tree of Life **BIO 1142** (16): Cell biology **CHE 1140** (16): General Chemistry for the Applied Sciences **MAT 1143** (8): Mathematics for Biological, Earth and Life Sciences I **PHY 1125** (8): Physics for Natural Sciences I **STA 1149** (8): Basic Statistics (for the Natural and Applied Sciences) **COM 0110** (4): Computer Literacy **ECS 1141** (10): English Communication Skills (Generic Module)	NONE	**132**
	2	**BIO 1243** (16): Ecology, Adaptation and Evolution **PHY 1225** (8): Physics for Natural Sciences II **MAT 1243** (8): Math for Biological, Earth and Life Sciences II **STA 1249** (8): Basic Statistical Inference (for the Natural and Applied Sciences) **COM 0210** (4): Computer Literacy **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	NONE	
Year 2 **NQF Level 6**	**1**	**BIO 2142** (16): Population Ecology **BOT 2144** (16): Plant Anatomy and Morphology **ZOO 2141** (16): Animal Physiology **ZOO 2144** (16): Principles of Genetics	NONE	**128**
	2	**BIO 2246** (16): Conservation Biology I **BOT 2245** (16): Plant Taxonomy and Reproductive Biology **BOT 2249** (16): Ethnobotany I **ZOO 2248** (16): Animal Phylogeny	NONE	
Year 3 **NQF Level 7**	**1**	**BOT 3148** (10): Plant Systematics **BIO 3144** (16): Basic Freshwater Ecology **BOT 3143** (10): Disturbance and Plant Ecology **ZOO 3141** (16): Animal Ecophysiology	NONE	**118**
	2	**BIO 3246** (16): Conservation Biology II **BOT 3241** (10): Ethnobotany II **BOT 3246** (10): Plant Physiology **BOT 3247** (10): Plant Ecophysiology **ZOO 3249** (20): Evolutionary Genetics	NONE	

In year 1: Take either COM 0110 **OR** COM 0210

4.3.3. DESCRIPTION OF UNDERGRADUATE MODULES OFFERED BY THE DEPARTMENT OF BIOLOGICAL SCIENCES PER SEMESTER

FIRST YEAR MODULES – SEMESTER 1:

BIO 1141 : The Tree of Life [credits 16]
Biological principles and the science of biology, the origin and chemistry of life, classification and phylogeny of animals, review of bacteria, fungi and viruses, kingdom protista (classification 7 characteristics), kingdom animalia (a general review), kingdom plantae (review, life cycles and theories of their possible origin).

BIO 1142 : Cell Biology [credits 16]
Organic chemistry: the scope of biochemistry, organic compounds of importance to the living system, structure, functional groups, stereochemistry and characteristics of the carbohydrates, lipids, proteins and nucleic acids, chemical-physical principles of biochemical bonds, matrix of life: weak interactions in an aqueous solution, energetics of life.
Cytology: history of cell biology, cell theory, membrane biology, structure and features of eukaryotic cells, techniques used in cytology. Prokaryotic cells**.**
Genetics: The nature and structure of the hereditary material introductory principles of mitosis and meiosis, Chromosome variation, sex determination and the mechanism of sex related inheritance.

FIRST YEAR MODULES – SEMESTER 2:

BIO 1243 : Ecology, Adaptation and Evolution [credits 16]
Ecosystems, Energy flow and nutrient cycling, Analysis of communities, ecological hierarchy and sampling methodology, species and their relationship, common and rare species, latitude gradients, interactive network and food webs, niches and competition, demography, dispersal, evolution and natural selection, microevolution, macroevolution, origin of life

BIO 1244 : Introductory Human Anatomy and Physiology [credits 12]
Introduction to human Physiology and Anatomy: chemical basis of life, introduction to cytology and cell physiology, histology: skin and integument, support and movement, integration and coordination, reproduction, processing and transportation

SECOND YEAR MODULES – SEMESTER 1:

BOT 2144 : Plant Anatomy and Morphology I [credits 16]
Pre-requisites : BIO 1141, BIO 1142
Introduction to plant tissues and their specialization: the leaf: adaptations of xerophytes and hydrophytes, processes in leaves, the stem: development, adaptation to desert, saline and aquatic habitats, transport, the root: tissues, mycorrhizae, nodules, differentiation, adaptation to xeric conditions, system of the root and the stem, mineral absorption, plant nutrient requirements, nitrogen and phosphorus cycle, specialized morphological features of plants, in relation to their role in adaptation, reproductive biology and classification.

BIO 2142 : Population Ecology [credits 16]
Pre-requisites : BIO 1141, BIO 1243
Population distribution and abundance, population dynamics, population growth, life histories, competition, predation, herbivory, parasitism, mutualism; energy flow and nutrient cycling in ecosystems; biomes and factors determining spatial distribution of life zones in the world and South Africa.

ZOO 2141 : Animal Physiology [credits 16]
Pre-requisites : BIO 1142, BIO 1243
Introduction to cell structure and functions of cell organelles, specialized cell types, cell division, principles of cellular transport, Structure and function of tissues, organs and organ systems, Nutrition and feeding, Structure and function of the respiratory systems, including movement of respiratory gases in, out and around the body, Structure and function of the urinary system, and its role in regulating body fluids, Characteristics of body structure of a range of invertebrates and vertebrates in particular to type of skeletal systems, and movement, structure and function of the nervous system including sense organs, initiation and transmission of nerve impulses and conduction across the synapse, co-ordination of the body in terms of sensory, integrative and motor functions of the nervous system

ZOO 2144 : Principles of Genetics [credits 16]
Pre-requisites : BIO 1142, BIO 1243
An introduction to the central principles of Genetics, covering the following topics: Genes and loci, Genetic markers and variation, DNA replication, Mutation, Recombination, Transcription, Protein synthesis (Translation), Regulation

of gene expression, Epigenetics, Genetic engineering, Genetic structure, Gene flow, Genetic drift, Selection, Artificial selection and domestication, Assortative mating/Sexual selection, Evolution, Mendelian Genetics, Hardy Weinberg Equilibrium.

SECOND YEAR MODULES – SEMESTER 2:

BIO 2142 : Population Ecology [credits 16]
Pre-requisites : BIO 1141, BIO 1243
Conditions and resources. Geometric population growth. Logistic population growth. Key factor. Life table and survivorship curve. Life history. Demographic stochasticity. Niche partitioning. Sample species richness.

BIO 2246 : Conservation Biology I [credits 16]
Pre-requisites : BIO 1141, BIO 1243
The natural world; principles and concepts; human impacts; habitat destruction and disturbance; sustainability; history of conservation biology; selecting protected areas, *in situ and ex situ* conservation issues; the landscape mosaic; managing for biodiversity; ecological restoration.

BOT 2245 : Plant Taxonomy and Reproductive Biology I [credits 16]
Pre-requisites : BIO 1141, BIO 1243
History of classification systems, species concept, principles of identification, nomenclature, description and classification of plants. Construction and use of keys, herbaria and botanical gardens, selected plant families. Pollination syndromes and seed dispersal mechanisms, evolution of flowers as reproductive organs, co-evolution of the flower-pollinator relationship.

BOT 2249 : Ethnobotany I [credits 16]
Pre-requisites : BIO 1141, BIO 1243
Definitions, history of the discipline, concrete and abstract relationships, scope of ethnobotany, indigenous knowledge systems, sub disciplines of ethnobotany, socio-ethnobotany, plants/animals and folklore, plants/animals and public education, protection of intellectual property rights, plants/animals and environmental management

ZOO 2248 : Animal Phylogeny [credits 16]
Pre-requisites : BIO 1141, BIO 1243
Introduction to evolutionary biology, the tree of life: classification and phylogeny, patterns of evolution, evolution in the fossil record, history of life on earth, biogeography, evolution of biodiversity. Major animal body plans

THIRD YEAR MODULES – SEMESTER 1:

Students are not allowed to proceed to do third year modules before clearing all first year modules.

BIO 3144 : Basic Freshwater Ecology [credits 16]
Pre-requisites : BIO 2142, BIO 2246
Identify the applicable ecological concepts, the physico-chemical aspects of water, the hydrological cycle, the global and national water situation. The definition, structure, classification and functioning of wetlands and riparian areas. The origin, classification, zonation and functioning of lentic water bodies. The origin, geomorphology, zoning and functioning lotic water bodies. A review of rivers, fresh water lakes and wetland types in a global and regional perspective. Processes within water bodies (gasses, nutrients, primary and secondary production and cycling of nutrients).

BOT 3143 : Plant Ecology [credits 10]
Pre-requisites : BIO 2142 or BOT 2144
Population structure and parameters, demographic techniques, introduction to population growth models, meta-populations, density and density-independent factors, competition, herbivory and predation, disturbance, disturbance parameters, agents mechanisms and effects of disturbance, population and community responses to disturbance, patch dynamics, habitat destruction and fragmentation, mechanism of alien invasion, characteristics of alien plant species, disturbance models, application of disturbance theory.

BOT 3148 : Plant Systematics [credits 10]
Pre-requisites : BOT 2245
Introduction. Brief History of Systematics. Species Concepts. Infra-specific Taxa. The integration of taxonomy (identification, nomenclature, classification emphasizing flowering plants), Plant systematics will explore the origin and diversification of land plants while emphasizing flowering plants. Taxonomic characters. Plant nomenclature. Morphology and terminology of vegetative and reproductive parts of plants. Phylo-genetics, Gymnosperm and Angiosperm classifications: Cronquist, and Tahitian. Reproductive features. Detailed study of selected families from monocotyledonous and dicotyledonous families and their economic importance with special emphasis to South

Africa. Laboratory emphasis on representative families and genera of flowering plants in South Africa, their economic importance, use of keys and manuals, Plant collection, identification and herbarium techniques.

ZOO 3141 : Animal Ecophysiology [credits 16]
Pre-requisites : ZOO 2141, ZOO 2144
The physics of heat exchange, heat transfer, heat balance and control systems, animal responses to the thermal environment, physics of water movement, evaporative water loss and water turnover rates, nutritional requirements, energy, energy metabolism and the energy budgets, communication in the ecosystem.

THIRD YEAR MODULES – SEMESTER 2:

Students are not allowed to proceed to do third year modules before clearing first year modules.

BIO 3246 : Conservation Biology II [credits 16]
Pre-requisites : BIO 2142, BIO 2246
Biodiversity, the creation of ecosystems; ethics of 21st century conversation, the central role of people ; political issues; ecosystem services; climate change and biodiversity; invasive alien organism; protested areas; species conversation ''green"economics; conserving the evolutionary process; conservation in forest-, savanna-, marine, drylands-, freshwater-, agricultural- and urban systems; conservation efforts, agreements and treaties.

BOT 3241 : Ethnobotany II [credits 10]
Pre-requisites : CHE 1140, BOT 2249
Data collection, organization, analysis, presentation and protection. Techniques of participatory rural appraisal; planning a long-term community project; history of plant based medicine; ecological role of secondary compounds: alkaloids, essential oils, phenolics and terpenoids. Basis and methodology for biological and chemical screening of plants and animal extracts for nutritional, medicinal and industrial properties (concepts, methods, tools and techniques). Conservation and community development.

BOT 3246 : Plant Physiology [credits 10]
Pre-requisites : CHE 1140, BOT 2244
Uptake, transportation and metabolism of some important minerals and water, photosynthesis, responses of plants to elevated atmospheric CO_2 concentrations and salinity.

BOT 3247 : Plant Ecophysiology [credits 10]
Pre-requisites : BOT 2144, BOT 2245
Ecophysiological research methodologies, climatic determinants, electromagnetic radiation, environmental factors and plant productivity, plant energy budgets, stable isotopes, temperature limits to plant life, soils, plants and disturbance in ecosystems and biogeochemical cycling.

ZOO 3249 : Evolutionary Genetics [credits 20]
Pre-requisites : ZOO 2144, ZOO 2248
The Central Dogma, Genes and Genomes, Extranuclear DNA, Molecular genetics, Darwin and Selection, Sexual selection, Adaptation, Mendel and Inheritance, Gene frequencies and allele frequencies, The Modern Synthesis, Genetic Drift and Migration, Recombination, Neutral vs Functional Variation, Epigenetics, Speciation, Molecular ecology, Conservation genetics, Ancient DNA, Measuring Genetic Diversity and Structure, Population genetics, Modelling and model testing, Coalescence, Phylogenetics, Gene trees, Species trees, Phylogenomics, Phylogeography.

4.4. BACHELOR OF SCIENCE HONOURS DEGREE [BSc. Hons] OFFERED IN THE DEPARTMENT OF BIOLOGICAL SCIENCES

4.4.1. ADMISSION REQUIREMENTS

Qualification	Qualification code	Duration	Admission requirements
BSc Hons Biological Sciences (Zoology)	MNHHZO	1 year	• A candidate will be allowed to register for the Honours degree only if he/she possesses a BSc degree or equivalent or subject to SENATE approval, if he/she has completed the modules for a BSc degree, or if equivalent status has been conferred on him/her by SENATE. • Candidates must have passed the final-year modules of the subject in which they wish to study with an aggregate of

			60%. Candidates with lower level passes may be accepted subject to SENATE approval. • Prospective candidate could be subjected to a final selection test which serves to assess their preparedness for the Honours course.
BSc Hons Biological Sciences (Botany)	MNHHBT	1 year	• A candidate will be allowed to register for the Honours degree only if he/she possesses a BSc degree or equivalent or subject to SENATE approval, if he/she has completed the modules for a BSc degree, or if equivalent status has been conferred on him/her by SENATE. • Candidates must have passed the final-year modules of the subject in which they wish to study with an aggregate of 60%. Candidates with lower level passes may be accepted subject to SENATE approval. • Prospective candidate could be subjected to a final selection test which serves to assess their preparedness for the Honours course.

4.4.2. RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture. (b) The honours degree is offered over ONE academic year and students write examinations and present themselves for continuous assessment during the year of registration. (c) **Project reports must be handed in before the 30th November of the academic year to graduate in the following May graduation.** (d) Except with the special permission of SENATE, the duration of the full-time study **will not exceed TWO years** (e) The degree will not be conferred on a candidate before at least one year has elapsed since he/she obtained the Bachelor's degree or another undergraduate degree as set out in the Faculty rules and unless he/she has been registered for one year at this University.
ASSESSMENT CRITERIA	(a) Candidates will only be assessed in a specific module if they attended lectures, tutorials and prescribed practical satisfactorily and obtained a semester mark of at least 50%. (b) A student **must** attain a minimum of 50% pass in **each** of the components of assessment. A student, who fails one of these components, will be allowed to repeat only that component. The written examination component will be conducted during the next normal examination period for that specific module. (c) All written examinations will be taken only during official examination sessions**.** (d) A candidate who fails two modules in the degree and obtains an aggregate of at least 50% may be admitted for assessment in those modules on one further sitting. (e) To obtain the degree cum laude, a candidate must attain an aggregate of 75% or higher. (f) To be awarded the BSc Hons degree, the candidate must accumulate at least 120 credits at this level. (g) Special examinations **will not be offered** in the BSc Hons degree. (h) An Aegrotat Examination may be granted to a student who has been prevented from sitting for the examination: • By illness on the day of the examination or assessment, or immediately before the examination or assessment, if a medical certificate from a registered medical practitioner is submitted to the Faculty, and/or if the student's application is supported by the invigilator concerned or another responsible person; or • Because of domestic circumstances such as serious illness or death of a close relative during the examination or assessment, or other reasons, if the Faculty judges it to be a bona fide case, and the student can provide satisfactory proof of such extraordinary circumstances.

4.4.3. BSc HONS: MODULE DESCRIPTIONS AND SPECIFIC RULES IN DEPARTMENT

BSc HONS IN BIOLOGICAL SCIENCES (BOTANY) [CODE: MNHHBT]

Each programme consists of six modules with a minimum total credit value of 120. To qualify for the BSc Honours degree a candidate must pass a minimum of **SIX** modules listed in the programme. The core and optional modules offered in an academic year may vary depending on the staffing situation in the departments.

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
BOT 5101 [credits 16]: Research Methodology	
Candidates must select a minimum of **four** modules from the following selection **which must include two** Botany (BOT) modules:	
BOT 5104 [credits 16]: Applied Plant Ecology	**BOT 5206 [credits 16]: Plant Physiology**
BOT 5105 [credits 16]: Applied Plant Ecophysiology	**BOT 5208 [credits 16]: Plant Systematics**
BIO 5110 [credits 16]: Freshwater Ecology	**BOT 5212 [credits 16]: Applied Ethnobotany**
BIO 5111 [credits 16]: Conservation Biology III	**ZOO 5207 [credits 16]: Molecular Ecology**
BCM 5301 [credits 15]: Research Methods and Seminars	**BCM 5222 [credits 12]: Research Techniques**
	MBY 5204 [credits 15]: The role of Microorganisms in Industrial Processes
	MBY 5205 [credits 15]: The Role of Micro-organisms in the Environment
COMPULSORY YEAR MODULES	
BOT 5302 [credits 42]: Research Project	
Total Credits only = 120	

BOT 5501 [credits 16]: Research Methodology Research Methodology
History and philosophy of science, the scientific method, literature search and administration, compilation and presentation of a literature review, project proposal, hypotheses, project report and scientific paper, computer as a research tool. Applied biometry, questionnaire survey, selected research techniques. The module code depends on the supervision of the Research Project. Candidates supervised by a staff member from the Botany Department will register for BOT and candidates supervised by a staff member from the Zoology Department will register for ZOO.

BOT 5104 [credits 16]: Applied Plant Ecology
Discussion of the biomes of South Africa, community sampling techniques, introduction to aerial-photo interpretation, plant community structure, composition and function, plant life forms, floristic vegetation analysis, succession, population structure and demographic processes, resource allocation and reproductive effort, population sampling techniques, population models, life history classification, plant reproductive strategies, regeneration ecology, species interactions, ecology of alien invasive plants.

BOT 5105 [credits 16]: Applied Plant Ecophysiology
Pre-requisites: BOT 3247
Plant distribution, function, response and performance with respect to drought, fire, cutting, grazing and so on; biochemical co-evolution.

BIO 5110 [CREDITS 16]: Freshwater Ecology
Pre-requisites: BIO 3144.
We examine four fundamental ecological questions that aquatic ecologists ask when assessing the distribution and abundance of organisms in freshwater systems. Fundamental ecological questions are used to identify key ecological processes that can play a role in determining the abundance of organisms in any freshwater ecosystem. Approaches to examine the regulation of water regimes, pollution, biomanipulation of food webs to improve water quality, and managing the impact of introduced species.

BIO 5111 [CREDITS 16]: Conservation Biology III
Pre-requisites: BIO 3246.
Concepts (niche, life history, migration and dispersion, small populations, meta-populations, population interactions, succession, food webs, ecosystem functioning, biodiversity, island biogeography, sustainability) and the applications (invasive aliens, restoration, conservation, minimum viable populations, habitat fragmentation, global climate change, economic thresholds, biological control, integrated pest management, eutrophication, agriculture, ecosystem health, conservation planning, economic implications.

BOT 5206 [credit 16]: Plant Physiology
Pre-requisites: BOT 3246
Plant mineral nutrition and ion uptake, nitrogen cycling in nature, metabolism of nitrogen, chemistry of photosynthesis, C_4 photosynthesis and crassulacean acid metabolism, Respiration in plants, mycorrhiza, responses of plants to elevated atmospheric and rhizospheric CO_2 concentration, salinity and water stress and photosynthesis, nutrient uptake and growth, seed physiology.

BOT 5208 [credits 16]: Plant Systematics
Pre-requisites: BOT3148.
Introduction to different classification systems. Scientific methods in plant systematics, floral terminology, Plant nomenclature. International Code of Botanical Nomenclature. The species concept. Natural and artificial classification methods. Rules and regulation of nomenclature. Biogeography. Systematics in biodiversity and conservation. Description and documentation and analysis of biological diversity. Detailed study of Gymnosperms, monocotyledonous and dicotyledonous families of major plant groups and their economic importance. Guide to Plant Collection, Identification and preservation. Field Techniques. Herbarium techniques.
Major project will be involved in the collection, identification, economic importance, and systematic study of a particular genera or species or plants of interest in Limpopo Province.

BOT 5212 [credits 16]: Applied Ethnobotany
Pre-requisites: BIO 3241
Approaches to field methodology; plant resources and plant products; scientific methodology and quantitative techniques; plant based products: composition, validation and innovation; policies and ethics; conservation and sustainable development.

ZOO 5207 [credits 16]: Molecular Ecology
Pre-requisites: ZOO 3249
Human Evolution: from Africa to the world, Host-parasite interactions, Inferring Genetic Structure, Inferring Admixture, Models and model testing, Maximum Likelihood vs Bayesian Inference, Heuristic parameter estimation, Markov Chain Monte Carlo Simulations, Approximate Bayesian Computation, Coalescent Theory, Migration-Drift Equilibrium, Changes in Effective Population Size, Trees vs Networks, "Model-free" inference, Genetic landscapes

BCM 5622 [credits 12]: Research Techniques
Hands-on applications of various advanced biochemical research techniques with emphasis on: extraction and purification of biomolecules; ultrasonication and ultracentrifugation; 2DGE; spectrometric methods (including SEC, fluorimetry, UV-Vis, CD-, FTIR, and MS- spectrometric); microscopic methods (fluorescence, SEM, TEM, HRTEM); NMR; FACS; microarrays; biomolecular interaction studies (including slot blot, far-Western, SPR, pull-down assays).

MBY 5204 [credits 15]: The Role of Microorganisms in Industrial Processes
Gene loss, amplification and arrangement; lac and galactose operons; gene library; recombination and screening; sequencing; restriction fragment length polymorphism analysis and related techniques; restriction mapping; plant biotechnology; fermentation systems; production of antibiotics and antibiotic sensitivity assays. Application of bacteria and fungi in industry. Quality control and quality assurance; intellectual property rights.

MBY 5205 [credits 15]: **The Role of Microorganisms in the Environment**
Advanced lecture on different microbes in the environment- soil, aquatic environment, air. Beneficial and pathogenic microorganisms in agriculture. Water and food borne pathogens- bacteria, fungi, parasites. Advanced lecture on indicator organisms. Biogeochemical cycles: (water, carbon, nitrogen, Sulphur, iron, phosphorous, oxygen). Bioremediation, biofilm formation and significance in bioremediation, corrosion, and disease. Environmental sample collection and identification of organisms. Water treatment- chlorination, chloramination, ozonation, irradiation. Domestic water treatment.
BOT 5302 [credits 42]: Research Project
A research project centered on the theme "*sustainable utilization and conservation of natural resources*".

BCM 5301 [credits 15]: Research Methods and Seminars
Research planning, data handling and scientific writing; presentation of research proposal and research progress (seminars); analysis of biochemistry research publications are conducted towards developing critical understanding (journal club). Ethical and philosophical issues in biochemistry research are addressed.

BSc HONS IN BIOLOGICAL SCIENCES (ZOOLOGY) [CODE: MNHHZO]

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
ZOO 5101 [credits 15]: Research Methodology	**ZOO 5207 [credits 15]: Molecular Ecology**
BIO 5111 [credits 15]: Conservation Biology III	**ZOO 5209 [credits 15]: Applied Animal Ecophysiology**
Candidate must register ONE (1) of the following:	
BIO 5110 [credits 15]: Freshwater Ecology	**ZOO 5206 [credits 15]: Invertebrate Diversity and Conservation**
COMPULSORY YEAR MODULES	
ZOO 5300 [credits 45]: Research Project	
Total Credits = 120	

ZOO 5101 [credits 15]: Research Methodology
History and philosophy of science, the scientific method, literature search and administration, compilation and presentation of a literature review, project proposal, hypotheses, project report and scientific paper, computer as a research tool. Applied biometry, questionnaire survey, selected research techniques.

BIO 5110 [credits 15]: Freshwater Ecology
Pre-requisites: BIO 3144.
We examine four fundamental ecological questions that aquatic ecologists ask when assessing the distribution and abundance of organisms in freshwater systems. Fundamental ecological questions are used to identify key ecological processes that can play a role in determining the abundance of organisms in any freshwater ecosystem. Approaches to examine the regulation of water regimes, pollution, biomanipulation of food webs to improve water quality, and managing the impact of introduced species.

BIO 5111 [credits 15]: Conservation Biology III
Pre-requisites: BIO 3246.
Concepts (niche, life history, migration and dispersion, small populations, meta-populations, population interactions, succession, food webs, ecosystem functioning, biodiversity, island biogeography, sustainability) and the applications (invasive aliens, restoration, conservation, minimum viable populations, habitat fragmentation, global climate change, economic thresholds, biological control, integrated pest management, eutrophication, agriculture, ecosystem health, conservation planning, economic implications.

ZOO 5206 [credits 15]: Invertebrate Diversity and Conservation
Pre-requisites: BIO 3246
Basic arachnid morphology; higher classification of the Arachnida; basic insect morphology; higher classification of the Class Insecta; designing sampling protocols; collecting and recording invertebrates; biodiversity and assemblage studies.

ZOO 5207 [credits 15]: Molecular Ecology
Pre-requisites: ZOO 3249
Human Evolution: from Africa to the world, Host-parasite interactions, Inferring Genetic Structure, Inferring Admixture, Models and model testing, Maximum Likelihood vs Bayesian Inference, Heuristic parameter estimation, Markov Chain Monte Carlo Simulations, Approximate Bayesian Computation, Coalescent Theory, Migration-Drift Equilibrium, Changes in Effective Population Size, Trees vs Networks, "Model-free" inference, Genetic landscapes

ZOO 5209 [credits 15]: Applied Animal Ecophysiology
Pre-requisites: ZOO 3141
Costs of living: Cost of production and cost of maintenance, cost of reproduction, trade-offs and their measurements, Physiological energetic (feeding, metabolism and growth): the comparative physiology of animal digestive system, feeding and digestion, optimal foraging and optimal digestion, constraints imposed by food items, Growth in animals: central concept, growth curves, metabolism and growth, physiology and cellular aspects of growth, the regulation and integration of growth, hormonal influences, environmental factors and growth, environmental tolerance, environmental stressors, Niche overlap and diet analysis: measurement of niche breadth and niche overlap, dietary preferences and indices, Reproduction: endocrine control, species difference in reproductive mechanisms, ovulation rate, embryonic mortality, gestation length, patterns of reproduction, pregnancy and lactation, the costing of reproduction, types of costing, trade-offs and their causes, the environment and reproduction

ZOO 5300 [credits 45]: Research Project
A research project centered on the theme: sustainable utilization and conservation of natural resources.

4.5. MASTERS (MSc) QUALIFICATIONS OFFERED IN THE DEPARTMENT OF BIOLOGICAL SCIENCES IS ONLY BY RESEARCH

4.5.1. ADMISSION REQUIREMENTS

Qualification	Qualification Code	Duration	Admission Requirements
MSc Life Sciences (Zoology)	MNMBSZ [Project: ZOO 6300]	2 years	• A 4 years Bachelor degree or Honours degree in Zoology with an average of 65%, an upper-second class for a class-based system with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental

			Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.
MSc Life Sciences (Botany)	MNMBSB [Project: BOT 6300]	2 years	• A 4 years Bachelor degree or Honours degree in Botany with an average of 65%, an upper-second class for a class-based system with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

4.5.2. RULES FOR PROGRESSION AND ASSESSMENT CRITERIA:

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title and topic of the proposed dissertation, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and the Faculty Higher Degrees Committee final approval. (b) The Research proposal, registration and ethics must be approved by the Deprtments Higher Degrees Committee and then send for final approval to the Faculty Higher Degrees Committee and UHDC. (c) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the Master's degree may be conferred only after the candidate has been registered for a period of at least TWO years fulltime. (d) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE. (e) The Research MSc degree is conferred based on a dissertation and an examination, or a dissertation only, as determined by the Faculty Academic Board. (f) The taught MSc degree is conferred based on a mini dissertation and a component of taught modules which must all be passed as per degree requirements (g) The Head of Department may prescribe certain ancillary modules which must be enrolled or passed before the date of the Master's examination. (h) The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture. (i) SENATE may, at any time, suspend or cancel the registration of any student who, in its view, is not making satisfactory progress. (j) Students who wish to defer their studies at **any stage MUST APPLY** to the relevant department. If granted, such deferment will be for **a maximum period of one year**, after which a further application must be submitted. Deferment will, **at most**, be granted twice. (k) Before registration for 2nd or further years, the student must write a full progress report for the year passed which is signed by the supervisor and the HOD to show progress, which will be approved /not approved by the Executive Dean. This progress report will count as the last quarterly report of the passed year for the student. **No** student will be allowed to register without the approval of the Executive Dean
ASSESSMENT CRITERIA	(a) Procedures as per post-graduate policies and guidelines will be followed – this includes the agreement between the student and supervisor that must be in placed as well as the quarterly reports that must be send to the Faculty Research office as proof of student's progress (b) Quarterly progress reports are compulsory

4.6. DOCTORAL (PhD) QUALIFICATIONS OFFERED BY THE DEPARTMENT OF BIOLOGICAL SCIENCES IS ONLY BY RESEARCH

4.6.1 ADMISSION REQUIREMENTS

Qualification	Qualification Code	Duration	Admission Requirements
PhD Life Sciences (Zoology)	MNPLSZ [Project: ZOO 7300]	3 years	• A MSc in Zoology with a minimum mark of 65% OR equivalent status conferred by SENATE • Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the Department's Higher Degrees Committee concerned for recommendation to the School's Higher Degree's committee and University higher degree's committee and approval by SENATE. The Research proposal must be approved by the • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.
PhD Life Sciences (Botany)	MNPLSB [Project: BOT 6300]	3 years	• A MSc in Botany with a minimum mark of 65% OR equivalent status conferred by SENATE • Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the Department's Higher Degrees Committee concerned for recommendation to the School's Higher Degree's committee and University higher degree's committee and approval by SENATE. The Research proposal must be approved by the • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

4.6.2 RULES FOR PROGRESSION AND ASSESSMENT CRITERIA:

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title and topic of the proposed thesis, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and then the Faculty Higher Degrees Committee for approval. (b) The Research proposal, registration of project and ethics application must be approved by the Departments and Faculty's Higher Degrees Committee before final approval by the UHDC. (c) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the degree may be conferred only after the candidate has been registered for a period of at least THREE years fulltime. (d) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE.

ASSESSMENT CRITERIA	(a) Procedures as per Postgraduate policy guidelines will be followed. This will include the agreement between the supervisor and the doctoral student and the quarterly progress reports that must be submitted in time to the Faculty Research office (b) External examination of thesis will be done as per Post Graduate policies (c) Viva Voce as per school postgraduate guidelines through the office of the Executive Dean. If a student fails the Viva Voce, the degree will not be awarded. (d) Quarterly progress reports are compulsory

SECTION 5:

DEPARTMENT: CHEMISTRY

5.1. QUALIFICATIONS OFFERED BY THE DEPARTMENT OF CHEMISTRY

Generic BSc degrees (BSc):

- BSc (PHYSICS AND CHEMISTRY) CODE: MNBBSJ
- BSc (CHEMISTRY AND MATHEMATICS) CODE: MNBBSK
- BSc (CHEMISTRY AND BIOCHEMISTRY) CODE: MNBBSL
- BSc (CHEMISTRY AND APPLIED CHEMISTRY) CODE: MNBBSN

BSc Hons degrees (BSc.Hons)

- BSc HONS CHEMISTRY CODE: MNHSHC

MSc degrees (MSc):

- MSc CHEMISTRY Project: CHE 6300 CODE: MNMMSC

PhD degrees (PhD):

- PhD CHEMISTRY Project: CHE 7300 CODE: MNPDPC

5.2. GENERIC BSc QUALIFICATION OFFERED BY THE DEPARTMENT OF CHEMISTRY [CREDITS = 360]

5.2.1. ADMISSIONS REQUIREMENTS, RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

ADMISSIONS REQUIREMENTS	(a) Candidates wishing to enroll for a Generic BSc degree in the Department of Biological Sciences in any of the undergraduate qualifications listed, must have obtained a minimum admission requirement in a National Senior Certificate (NSC) as certified by the Council for General and Further Education and Training (Umalusi) with an achievement rating of **4** (adequate achievement, 50-59%) or better in **each** of the following four recognised 20-credit NSC subjects: • English • Mathematics • Physical Science • Life Sciences (b) Any other related subject as judged by the HOD of the responsible department and approved by the Executive Dean of the Faculty (c) Candidates may be subjected to a selection procedure as determined by the Faculty board. (d) Equivalent FET Level 4 qualifications in any of the above subjects may also be considered. (e) Students from the Extended BSc Degree Programme should have obtained 120 credits from the 12 modules registered for, before admission to the listed mainstream degree.
RULES FOR PROGRESSION	**Students from the foundation year:** (a) All outstanding Foundation year modules **must be** registered for and passed during year 2 of the extended programme. (b) Students will not be allowed to move to year 3 of the extended programme or take any second-year mainstream modules if they still have **outstanding extended/foundation 1st year modules**. (c) A third-year extended programme student who has passed 60% of his/her second-year modules **may only** register third year modules whose Pre-requisites have been met, subject to the approval of the Head of Department and the Executive Dean. (d) Students may not select modules that clash on the lecturing and practical timetables. (e) No curriculum change, whether within or from outside the Faculty, will be recognized unless approved by the Executive Dean. (f) A full-time student may take a maximum of 32 credits over and above the minimum 360 credits required for the degree, **subject to the approval of the Head of Department and the Executive Dean**.

	(g) Students can register ONLY for modules for which **ALL** pre-requisites have been satisfied. (h) Students retain credits for all modules passed. (i) To qualify for a BSc degree in the Faculty, students must obtain a minimum of half of their credits in a learning stream within the Faculty of Sciene, Engineering and Agriculture. **Students registered for 3 year BSc degree:** (a) A student **may only progress to the second-year level** when she/he has passed 60% of the 1st year modules in the mainstream BSc degree (b) To progress to the third-year level, a student must have passed **ALL** first- and second-year modules. (c) Students may not select modules that clash on the lecturing and practical timetables. (d) No curriculum change, whether within or from outside the Faculty, will be recognized unless approved by the HOD and the Executive Dean. (e) A full-time student may take a maximum of 32 credits over and above the minimum 360 credits required for the degree, **subject to the approval** of the Head of Department and the Executive Dean. (f) Students can register **ONLY** for modules for which **ALL** Pre-requisites have been satisfied**.** (g) Students retain credits for all modules passed. (h) To qualify for a BSc degree in the School of Mathematical and Natural Sciences, students **must obtain a minimum** of half of their credits in a learning stream within this School. (i) To obtain a degree from the School, students must have earned at least 360 credits including all core and fundamental modules in one of the generic Bachelor of Science qualifications. Departments may prescribe additional credits **provided these do not exceed** 32 credits. (j) The minimum registration period for a BSc. degree is three years and the maximum is n+2.
ASSESSMENT CRITERIA	(a) Continuous Assessment will be determined by the Department and approved by the Faculty Board and consist of tests, practical sessions and tests, tutorials, projects, assignments and reports. (b) Students will write examinations at the end of each semester on condition that they qualify to do so. (c) The minimum final pass mark in any module is 50%. (d) To obtain the degree or diploma cum laude, a candidate must attain an aggregate of 75% or higher.

5.2.2. THE BSc QUALIFICATIONS OFFERED IN THE DEPARTMENT OF CHEMISTRY

BSc (PHYSICS AND CHEMISTRY) **[CODE: MNBBSJ]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**CHE 1140** (16): General Chemistry for the Applied Sciences **PHY 1121** (8): Mechanics **PHY 1122** (8): Waves and Optics I **MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematics Foundation I **COM 0110** (4): Computer Literacy **ECS 1145** (10): English Communication Skills	**BIO 1141** (16): The Tree of Life **BIO 1142** (16): Cell Biology **COM 1321** (16): Object Oriented Programming **[Please note: this is a year module]** **STA 1141** (8): Introduction to Statistics	**136**
	2	**CHE 1221** (8): Inorganic Chemistry I **CHE 1222** (8): Organic Chemistry I **PHY 1223** (8): Properties of Matter and Heat **PHY 1224** (8): Electricity and Magnetism **MAT 1241** (8): Integral Calculus **MAT 1242** (8): Mathematics Foundation II **COM 0210** (4): Computer Literacy **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**BIO 1243** (16): Ecology, Adaptation and Evolution **STA 1241** (8): Elementary Statistical Method I - Introductory Interference	
Year 2 **NQF Level 6**	**1**	**CHE 2121** (10): Inorganic Chemistry II **CHE 2122** (10): Organic Chemistry II **PHY 2121** (10): Classical Mechanics **PHY 2122** (10): Waves and Optics II **MAT 2141** (10): Linear Algebra **MAT 2142** (10): Multivariable Calculus	**COM 2123** (10): Imperative Programming **COM 2128** (10): Artificial Intelligence Fundamentals **COM 2129** (10): Database Fundamentals	**120**
	2	**CHE 2220** (10): Analytical Chemistry: Classical Techniques **CHE 2223** (10): Physical Chemistry I **PHY 2223** (10): Electrodynamics **PHY 2224** (10): Modern Physics	**COM 2229** (10): Systems Analysis **MAT 2241** (10): Real Analysis I **MAT 2242** (10): Ordinary Differential Equations I	
Year 3 **NQF Level 7**	**1**	**CHE 3120** (14): Analytical Chemistry: Instrumental Techniques **CHE 3123** (14): Physical Chemistry II **PHY 3121** (14): Atomic and Nuclear Physics **PHY 3122** (14): Solid State Physics	NONE	**112**
	2	**CHE 3221** (14): Inorganic Chemistry III **CHE 3222** (14): Organic Chemistry III **PHY 3223** (14): Thermodynamics and Statistical Mechanics **PHY 3224** (14): Quantum Mechanics	NONE	

In year 1:
- Take modules in total of 16 credits from the elective module list
- Take either COM 0110 **OR** COM 0210
- Please note that the **COM 1321** module is an elective and a year module which must be registered in the 1st semester

In year 2:
- Take modules in total of 20 credits from the elective module list

BSc (CHEMISTRY AND MATHEMATICS) [CODE: MNBBSK]

YEAR	SEMESTER	COMPULSAORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**CHE 1140** (16): General Chemistry for the Applied Sciences **MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematics Foundation I **PHY 1121** (8): Mechanics **PHY 1122** (8): Waves and Optics I **COM 0110** (4): Computer Literacy **ECS 1141** (10): English Communication Skills (Generic Module)	**BIO 1141** (12): The Tree of Life **BIO 1142** (12): Cell Biology **COM 1321** (16): Object Oriented Programming **[Please note: this is a year module]** **STA 1141** (8): Introduction to Statistics	**136**
	2	**CHE 1221** (8): Inorganic Chemistry I **CHE 1222** (8): Organic Chemistry I **MAT 1241** (8): Integral Calculus **MAT 1242** (8): Mathematics Foundation II **PHY 1223** (8): Properties of Matter and Heat **PHY 1224** (8): Electricity and Magnetism **COM 0210** (4): Computer Literacy **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**STA 1241** (8): Elementary Statistical Method I - Introductory Interference **MAT 1247** (8): Numerical Analysis I **BIO 1243** (16): Ecology, Adaptation and Evolution	
Year 2 **NQF Level 6**	**1**	**CHE 2121** (10): Inorganic Chemistry II **CHE 2122** (10): Organic Chemistry II **MAT 2141** (10): Linear Algebra **MAT 2142** (10): Multivariable Calculus	**COM 2123** (10): Imperative Programming **COM 2128** (10): Artificial Intelligence Fundamentals **COM 2129** (10): Database Fundamentals **PHY 2121** (10): Classical Mechanics **PHY 2122** (10): Waves and Optics II	**120**
	2	**CHE 2220** (10): Analytical Chemistry: Classical Techniques **CHE 2223** (10): Physical Chemistry I **MAT 2241** (10): Real Analysis I **MAT 2242** (10): Ordinary Differential Equations I	**COM 2216** (10): Reasoning about Programs **COM 2229** (10): Systems Analysis **PHY 2223** (10): Electrodynamics **PHY 2224** (10): Modern Physics **MAT 2247** (10): Numerical Analysis II	
Year 3 **NQF Level 7**	**1**	**CHE 3120** (14): Analytical Chemistry: Instrumental Techniques **CHE 3123** (14): Physical Chemistry II **MAT 3141** (14): Real Analysis II **MAT 3142** (14): Group Theory	**MAT 3147** (14): Partial Differential Equations	**126**
	2	**CHE 3221** (14): Inorganic Chemistry III **CHE 3222** (14): Organic Chemistry III **MAT 3241** (14): Complex Analysis **MAT 3248** (14): Mathematical Modelling II	**MAT 3242** (14): Rings and Fields **MAT 3247** (14): Numerical Analysis III	

In year 1:
- Take modules in total of 16 credits from the elective module list
- Take either COM 0110 **OR** COM 0210
- Please note that the **COM 1321** module is an elective and a year module which must be registered in the 1st semester

In year 2:
- Take modules in total of 40 credits from the elective module list

In year 3:
- Take modules in total of 14 credits from the elective module list

BSc (CHEMISTRY AND BIOCHEMISTRY) [CODE: MNBBSL]

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**CHE 1140** (16): General Chemistry for the Applied Sciences **MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematics Foundation I **BIO 1141** (16): The Tree of Life **BIO 1142** (16): Cell Biology **PHY 1125** (8): Physics for Natural Sciences I **COM 0110** (4): Computer Literacy **ECS 1141** (10): English Communication Skills (Generic Module)	NONE	**136**
	2	**CHE 1221** (8): Inorganic Chemistry I **CHE 1222** (8): Organic Chemistry I **MAT 1241** (8): Integral Calculus **MAT 1242** (8): Mathematics Foundation II **PHY 1225** (8): Physics for Natural Sciences II **COM 0210** (4): Computer Literacy **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	NONE	
Year 2 **NQF Level 6**	**1**	**BCM 2121** (10): Structural and functional Biochemistry I **BCM 2122** (10): Biochemical and Molecular Techniques **CHE 2121** (10): Inorganic Chemistry II **CHE 2122** (10): Organic Chemistry II **MBY 2121** (10): Bacteriology **MBY 2122** (10): Immunology	NONE	**120**
	2	**BCM 2221** (10): Structural and Functional Biochemistry II **BCM 2222** (10): Metabolism **CHE 2220** (10): Analytical Chemistry: Classical Techniques **CHE 2223** (10): Physical Chemistry I **MBY 2223** (10): Environmental Microbiology **MBY 2224** (10): Virology	NONE	
Year 3 **NQF Level 7**	**1**	**CHE 3120** (14): Analytical Chemistry: Instrumental Techniques **CHE 3123** (14): Physical Chemistry II **BCM 3121** (16): Protein Biochemistry **BCM 3122** (16): Advanced Molecular Techniques	NONE	**120**
	2	**CHE 3221** (14): Inorganic Chemistry III **CHE 3222** (14): Organic Chemistry III **BCM 3221** (16): Enzymology and Enzyme Biotechnology **BCM 3222** (16): Gene Expression, Protein Synthesis and Bioinformatics	NONE	

In year 1: Take either COM 0110 **OR** COM 0210

BSc (CHEMISTRY AND APPLIED CHEMISTRY) **[CODE: MNBBSN]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**CHE 1140** (16): General Chemistry for the Applied Sciences **MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematics Foundations I **PHY 1121** (8): Mechanics **PHY 1122** (8): Waves and Optics I **COM 0110** (4): Computer Literacy **ECS 1141** (10): English Communication Skills (Generic Module)	**BIO 1141** (16): The Tree of Life **BIO 1142** (16): Cell Biology **COM 1124** (8): Fundamentals of Computer Architecture **COM 1321** (16): Object Oriented Programming **[Please note: this is a year module]** **STA 1141** (8): Introduction to Statistics	**136**
	2	**CHE 1221** (8): Inorganic Chemistry I **CHE 1222** (8): Organic Chemistry I **MAT 1241**(8): Integral Calculus **MAT 1242** (8): Mathematics Foundations II **PHY 1223** (8): Properties of Matter and Heat **PHY 1224** (8): Electricity and Magnetism **COM 0210** (4): Computer Literacy **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**BIO 1243** (16): Ecology, Adaptation and Evolution **STA 1241** (8): Elementary Statistical Method I - Introductory Interference	
Year 2 **NQF Level 6**	**1**	**CHE 2121** (10): Inorganic Chemistry II **CHE 2122** (10): Organic Chemistry II **CHE 2124** (10): Industrial Chemistry **CHE 2125** (10): Applied Organic Chemistry **PHY 2122** (10): Waves and Optics II	**COM 2123** (10): Imperative Programming **COM 2128** (10): Artificial Intelligence Fundamentals **COM 2129** (10): Database Fundamentals **MAT 2141** (10): Linear Algebra **MAT 2142** (10): Multivariable Calculus **MBY 2121** (10): Bacteriology **PHY 2121** (10): Classical Mechanics	**120**
	2	**CHE 2220** (10): Analytical Chemistry: Classical techniques **CHE 2223** (10): Physical Chemistry I **CHE 2226** (10): Introductory Chemometrics **CHE 2229** (10) : Environmental Chemistry Fundamentals **PHY 2224** (10): Modern Physics	**COM 2229** (10): Systems Analysis **MAT 2241** (10): Real Analysis I **MAT 2242** (10): Ordinary Differential Equations I **PHY 2223** (10): Electrodynamics **MBY 2223** (10): Environmental Microbiology	
Year 3 **NQF Level 7**	**1**	**CHE 3120** (14): Analytical Chemistry: Instrumental Techniques **CHE 3123** (14): Physical Chemistry II **CHE 3124** (14): Applied Chemical Analysis and Food Science **CHE 3125** (14): *Capita Selecta* in Applied Chemistry	NONE	**112**
	2	**CHE 3221** (14): Inorganic Chemistry III **CHE 3222** (14): Organic Chemistry III **CHE 3226** (14): Process Technology **CHE 3227** (14): Chemistry of Materials	NONE	

In year 1:
- Take modules in total of 16 credits from the elective module list
- Take either COM 0110 **OR** COM 0210
- Please note that the **COM 1321** module is an elective and a year module which must be registered in the 1st semester

5.2.3. MODULE OUTLINES OFFERED BY THE DEPARTMENT OF CHEMISTRY

(a) Service Modules:

Note: Students registered for service modules wouldn't be permitted to register for second year mainstream modules and/or subsequent mainstream modules.

FIRST YEAR MODULES – SEMESTER 1:

CHE 1145 : General Chemistry for the Applied Sciences [credits 12]
The nature of Chemistry, scientific method, measurement and properties of matter. Phase equilibria, kinetic-molecular theory, chemical reactions and their laws (stoichiometry). Atomic structure and chemical bonding. Classification of compounds, oxidation numbers, redox reactions, and electrochemistry. Thermochemistry, chemical equilibrium, and chemical kinetics. Solutions and their description: solubility and concentration; colligative properties: freezing point depression, osmosis.

FIRST YEAR MODULES – SEMESTER 2:

CHE 1223 : Inorganic Chemistry for the Applied Sciences [credits 12]
Co-requisites : CHE 1140 or CHE 1145
Periodic relationships among the elements. Descriptive chemistry of representative elements of Groups I to VIII: General characteristics; atomic and ionic radii; ionization energies; important binary and ternary salts; variations from the group norms; metals, metalloids and non-metals; preparation and uses; catenation: rings and chains; organometallic compounds; hydrides, halogen-halogen bonding; compounds and ions of the noble gases. Acid-base chemistry: Definitions of acids and bases; theories based on anion transfer; Lewis theory - electron-pair donors and acceptors; the Usanovich definition; relationship between acid-base and oxidation-reduction reactions; proton donors and acceptors in aqueous solution; soft and hard acids and bases; quantitative aspects of Lewis acid-base theory.

CHE 1224 : Organic Chemistry for the Applied Sciences [credits 12]
Co-requisites : CHE 1140 or CHE 1145
Structure of organic compounds, stereoisomerism. Nomenclature, preparation and reactions of saturated and unsaturated hydrocarbons. Descriptive aliphatic chemistry per the most important functional groups. Haloalkanes, aryl halides and alkanols - substitution and elimination reactions. Introduction to optical isomerism. Chemistry of the carbonyl group and amines. Aromaticity and nitration, sulfonation, halogenation, and alkylation of benzene.

(b) Mainstream Modules:

FIRST YEAR MODULES – SEMESTER 1:

CHE 1140 : General Chemistry for the Applied Sciences [credits 16]
Introductory concepts: the nature of Chemistry, scientific method, measurement and properties of matter. Phase equilibria: kinetic-molecular theory: intermolecular forces, solids, liquids, and gases. Chemical reactions and their laws (stoichiometry). Atomic structure and chemical bonding. Classification of compounds, oxidation numbers and redox reactions. Thermochemistry: enthalpy of formation, enthalpy of reaction. Solutions and their description: solubility and concentration; colligative properties: freezing point depression, osmosis. Chemical kinetics: rate of reaction, effect of temperature, pressure, and concentration on reaction rate, catalysis. Chemical equilibrium: reversibility, equilibrium constant, effect of temperature, pressure, and concentration on equilibria. Electrochemistry: electrolytic and voltaic cells.

CHE 1221 : Inorganic Chemistry I [credits 8]
Co-requisites : CHE 1140 or CHE 1145
Periodic relationships among the elements. Descriptive chemistry of representative elements of Groups I to VIII: General characteristics; atomic and ionic radii; ionization energies; important binary and ternary salts; variations from the group norms; metals, metalloids and non-metals; preparation and uses; catenation: rings and chains; organometallic compounds; hydrides, halogen-halogen bonding; compounds and ions of the noble gases. Secondary chemical interactions: Electrostatic energies and dipole moments; dipole-dipole interactions; ion-dipole interactions; hydration of ions by solvent water; induced dipoles; hydrogen bonding; inclusion compounds. Acid-base chemistry: Definitions of acids and bases; theories based on anion transfer; Lewis theory - electron-pair donors and acceptors; the Usanovich definition; relationship between acid-base and oxidation-reduction reactions; proton donors and acceptors in aqueous solution; soft and hard acids and bases; quantitative aspects of Lewis acid-base theory.

FIRST YEAR MODULES – SEMESTER 2:

CHE 1222 : Organic Chemistry I [credits 8]
Co-requisites : CHE 1140 or CHE1145
Structure, bonding and geometry of organic compounds. Nomenclature, preparation and reactions of saturated and unsaturated hydrocarbons. Aromaticity and nitration, sulfonation, halogenation, and nitration of benzene. Descriptive aliphatic chemistry according to the most important functional groups, with emphasis on mechanisms. Haloalkanes, aryl halides and alkanols - substitution and elimination reactions. Introduction to molecular symmetry and optical isomerism. Chemistry of the carbonyl group and amines.

SECOND YEAR MODULES – SEMESTER 1:

CHE 2121 : Inorganic Chemistry II [credits 10]
Pre-requisites : CHE 1221
Transition elements: properties common to the transition elements; oxidation state tendencies and their causes; comparison of the 3d, 4d, and 5d elements, occurrence, isolation, and uses of the free elements; coordination compounds and complex ions; low coordinate geometries, tetrahedral, square planar, and intermediate geometries; structural, geometrical and optical isomerism; trigonal bipyramidal, square pyramidal, and intermediate geometries; octahedral and distorted octahedral complexes. Structure and bonding models in ionic and covalent compounds: Crystal and Ligand Field Theories and Molecular Orbital Theory; the linear combination of atomic orbitals approach; molecular orbital designations; heteronuclear diatomic molecules, polyatomic molecules; covalent bonds and bond energies; shapes and polarities of molecules; ionic bonding and the solid state.

CHE 2122 : Organic Chemistry II [credits 10]
Pre-requisites : CHE 1222
Conformational analysis of alkanes and cycloalkanes, stereochemistry of additions to alkenes and alkynes. Static stereochemistry: Chirality, sequence rules, enantiomers, diastereomers, *meso* compounds and racemic mixtures. Chemistry of haloalkanes: Dynamic stereochemistry, kinetics and thermodynamics of nucleophilic substitution (S_N1 and S_N2) and elimination (E_1 and E_2) reactions. Electrophilic aromatic substitution: substituent effects. Chemistry of the carbonyl group: nucleophilic addition, alpha substitution, condensation reactions. Aliphatic and aromatic amines and phenols. Application of IR and UNIVEN-Visible spectroscopy in organic chemistry.

CHE 2124 : Industrial Chemistry [credits 10]
Pre-requisites : CHE 1140, CHE 1221, CHE 1222.
Co-requisites : CHE 2121, CHE 2122
Introduction to the chemical industry: characteristics, scale, socioeconomic factors, major sectors, environmental issues. History and development of the chemical industry, the future, SA industry. Raw material sources: minerals, oil, natural gas, synthesis gas, C_1 building blocks. Heavy industrial inorganic chemicals: sources, limestone and derivatives, salt and soda, fertilizers. Process applications: chlor-alkali, cement, ammonia, nitric acid, sulphuric acid.

CHE 2125 : Applied Organic Chemistry [credits 10]
Pre-requisites : CHE 1222.
Co-requisites : CHE 2122, CHE 2124.
Introduction to heavy industrial organic chemistry. Olefins: hydrocarbon cracking, special syntheses, metathesis, diolefins: butadiene, isoprene, chloroprene. Ethylene oxidation products: ethylene oxide and derivatives, acetaldehyde, acetic acid, ketene. Biochemical materials, introduction to polymer chemistry: thermoplastics and thermosets, tacticity, olefin polymerization, natural rubber and poly-isoprene, formaldehyde resins, terephthalates, nylon, polyurethane, epoxy resins.

SECOND YEAR MODULES – SEMESTER 2:

CHE 2220 : Analytical Chemistry: Classical techniques [credits 10]
Pre-requisite : CHE 1140
Co-requisites : CHE 2121
Sampling, sample preparation and statistical analysis of analytical data. Gravimetry. Principles of titrimetry. Precipitation titrimetry. Complex-formation titrimetry. Oxidation-reduction titrimetry. Choice of analytical methods, statistical analysis.

CHE 2223 : Physical Chemistry I [credits 10]
Pre-requisite : CHE 1140
Co-requisites : MAT 1141, MAT 1241, PHY 1125, PHY 1225.

Gases and their laws, the First Law of thermodynamics. Heat capacities, mechanical (PV) work, thermochemistry. The Second Law of thermodynamics, free energy functions and the chemical potential. Phase equilibria, binary mixtures, chemical reactions and chemical equilibrium.

CHE 2226 : Introductory Chemometrics [credits 10]
Pre-requisites : MAT 1142, MAT 1242
Co-requisites : CHE 2220
Sampling and sample preparation, choice of analytical methods. Statistical treatment of chemical data, experimental design, quality assurance.

CHE 2229 : Environmental Chemistry Fundamentals [credits 10]
Pre-requisites : CHE 1140, CHE 1221, CHE 1222
Environmental change over time and space, Global cycles, Qualitative and quantitative criteria of environmental quality. The atmosphere: emissions, dust and aerosols. Water: Chemistry of continental waters and the oceans; quality criteria for drinking water, sewage treatment and waste disposal. The geosphere: Silicate materials, chemical weathering and leaching, sediments and clays. Natural and anthropogenic unwanted additives and contaminants in food. Managing hazardous substances: Ecotoxicology and risk assessment. Measuring environmental change: Methodology and analytical methods.

THIRD YEAR MODULES – SEMESTER 1:

Students are not allowed to proceed to do third year modules before clearing all first year modules.

CHE 3120 : Analytical Chemistry: Instrumental Techniques [credits 14]
Pre-requisites : CHE 2220
Co-requisites : CHE 3123
Instrumentation, principles and applications selected from: UNIVEN-Visible instrumentation and analysis; separation methods: extraction, chromatography, electrophoresis, mass spectrometry; electrochemical methods of analysis: potentiometry, coulometry, polarography; flame emission and atomic absorption spectrometry; fluorescence and phosphorescence; thermal analysis.

CHE3123 : Physical Chemistry II [credits 14]
Pre-requisites : CHE 2223.
Topics selected from: Surface chemistry, electrochemistry, Chemical kinetics and reaction mechanisms.

CHE 3124 : Applied Chemical Analysis and Food Science [credits 14]
Pre-requisites : CHE 2122
Co-requisites : CHE 2220, CHE 3120
Surface analysis, thermal methods, chromatography, chemistry and technology of food.

CHE 3125 : *Capita Selecta* in Applied Chemistry [credits 14]
Pre-requisites : CHE 2226
Co-requisites : CHE 3120, CHE 3123, CHE 3124.
Topics selected from, *inter alia*: Multiple and curvilinear regression. Optimization and operations research. Quality and environmental standards: ISO9000 and ISO14000. Intellectual property rights: Copyright, trademarks, trade secrets, patents.

THIRD YEAR MODULES – SEMESTER 2:

Students are not allowed to proceed to do third year modules before clearing all first year modules.

CHE 3221 : Inorganic Chemistry III [credits 14]
Pre-requisites : CHE 2121
Co-requisites : CHE 3120, CHE 3123, CHE 3222.
Transition metal complexes: coordination chemistry, theory, structure and reactivity. Bonding models for transition metal complexes in detail (CFT, LFT, MOT). Binuclear complexes, metal salts and solvate complexes; ligand substitution reactions; oxidation-reduction reactions; oxidative addition and reductive elimination reactions. Organometallic chemistry and catalysis: synthesis, structure and bonding, reaction pathways. Lanthanides, actinides and transactinides. Reaction kinetics of coordination compounds. Thermodynamic and related aspects of ligand fields. Solid state and coordination compounds. Bonding in cluster compounds.

CHE 3222 : Organic Chemistry III [credits 14]
Pre-requisites : CHE 2122
Co-requisites : CHE 3120, CHE 3123, CHE 3221.
Aromatic and hetero-aromatic compounds. Introductory heterocyclic chemistry and synthesis of heterocyclic compounds. Carbonyl addition reactions: enamines, imines, oxazolines, aldol condensation and variations. MS and NMR spectroscopy.

CHE 3226 : Process Technology [credits 14]
Pre-requisites : CHE 2223
Co-requisites : CHE 3123, CHE 3221, CHE 3222, CHE 3227
Principles of chemical process technology. Flow diagrams, mass and energy balances, heat transfer and mass transfer. Reactor types, unit operations: distillation, extraction and flotation. Petro-chemistry and microbiological processes. Process control.

CHE 3227 : Chemistry of Materials [credits 14]
Pre-requisites : CHE 1140, CHE 2121, CHE 2122
Co-requisites : CHE 3221, CHE 3226
Chemistry and technology of: Metals and alloys; ceramics; polymers, paints and adhesives; glass; construction materials such as cement, concrete and bricks.

5.3 BACHELOR OF SCIENCE HONOURS DEGREE [BSc. Hons] OFFERED IN THE DEPARTMENT OF CHEMISTRY

5.3.1. ADMISSION REQUIREMENTS

Qualification	Qualification Code	Duration	Admission Requirements
BSc Hons Chemistry	MNHSHC	1 year	• A candidate will be allowed to register for the Honours degree only if he/she possesses a BSc degree or equivalent or subject to SENATE approval, if he/she has completed the modules for a BSc degree, or if equivalent status has been conferred on him/her by SENATE. • Candidates must have passed the final-year modules of the subject in which they wish to study with an aggregate of 60%. Candidates with lower level passes may be accepted subject to SENATE approval. • Prospective candidate could be subjected to a final selection test which serves to assess their preparedness for the Honours course.

5.3.2. RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a)	The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture.
	(b)	The honours degree is offered over ONE academic year and students write examinations and present themselves for continuous assessment during the year of registration.
	(c)	**Project reports must be handed in before the 30th November of the academic year to graduate in the following May graduation.**
	(d)	Except with the special permission of SENATE, the duration of the full-time study **will not exceed TWO years**
	(e)	The degree will not be conferred on a candidate before at least one year has elapsed since he/she obtained the Bachelor's degree or another undergraduate degree as set out in the Faculty rules and unless he/she has been registered for one year at this University.
ASSESSMENT CRITERIA	(a)	Candidates will only be assessed in a specific module if they attended lectures, tutorials and prescribed practical satisfactorily and obtained a semester mark of at least 50%.
	(b)	A student **must** attain a minimum of 50% pass in **each** of the components of assessment. A student, who fails one of these components, will be allowed to repeat only that component. The written examination component will be conducted during the next normal examination period for that specific module.
	(c)	All written examinations will be taken only during official examination sessions**.**
	(d)	A candidate who fails two modules in the degree and obtains an aggregate of at least 50% may be admitted for assessment in those modules on one further sitting.

	(e) To obtain the degree cum laude, a candidate must attain an aggregate of 75% or higher. (f) To be awarded the BSc Hons degree, the candidate must accumulate at least 120 credits at this level. (g) Special examinations **will not be offered** in the BSc Hons degree. (h) An Aegrotat Examination may be granted to a student who has been prevented from sitting for the examination: • By illness on the day of the examination or assessment, or immediately before the examination or assessment, if a medical certificate from a registered medical practitioner is submitted to the Faculty, and/or if the student's application is supported by the invigilator concerned or another responsible person; or • Because of domestic circumstances such as serious illness or death of a close relative during the examination or assessment, or other reasons, if the Faculty judges it to be a bona fide case, and the student can provide satisfactory proof of such extraordinary circumstances.

5.3.3. BSc HONS: QUALIFICATIONS AND MODULE DESCRIPTIONS

BSc HONS (CHEMISTRY) [CODE: MNHSHC]

Students are advised to consult the head of the department regarding the modules offered in a year. To qualify for the BSc Honours degree a candidate must pass a minimum of **SIX** modules and CHE 5300 listed in the programme.

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
CHE 5130 [credits 14]: Analytical Chemistry	
CHE 5131 [credits 14]: Inorganic Chemistry	
CHE 5132 [credits 14]: Organic Chemistry	
CHE 5133 [credits 14]: Physical Chemistry	
OPTIONAL SEMESTER 1 MODULES	**OPTIONAL SEMESTER 2 MODULES**
CHE 5138 [credits 14]: Analytical and Inorganic Chemistry of Natural Products	**CHE 5238 [credits 14]: Natural Products Chemistry**
A student who fails one module in the first semester may be allowed to replace the failed module by an additional, equivalent 2nd semester module in consultation with the HOD.	
	CHE 5230 [credits 14]: *Capita Selecta*: Analytical Chemistry
	CHE 5231 [credits 14]: *Capita Selecta*: Inorganic Chemistry
	CHE 5232 [credits 14]: *Capita Selecta*: Organic Chemistry
	CHE 5233 [credits 14]: *Capita Selecta*: Physical Chemistry
COMPULSORY YEAR MODULES	
CHE 5300 [credits 42]: Research project	
Total Credits only = 120	

CHE 5130 [credits 14]: Analytical Chemistry
Separation methods: chromatography, electrophoresis and mass spectrometry**.** Atomic and molecular spectroscopy**.** Statistical treatment of analytical results.

CHE 5131 [credits 14]: Inorganic Chemistry
Pre-requisites: Second-year Mathematics.
Inorganic polymers: chains, rings, cages and clusters. Recent developments in coordination chemistry: organometallic complexes, nonaqueous solvents. Transition metal storage, transport and biomineralization. Reaction pathways of zinc enzymes and related biological catalysts. Calcium in biological systems.

CHE 5132 [credits 14]: Organic Chemistry
Spectroscopy: Physical methods for the structure elucidation of natural products. Synthesis design: functional group transformations, protection and C-C bond formation strategies. Modern synthetic methods, including neighbouring group participation, carbanion and carbene chemistry; heteroatom-stabilized carbanions. Advanced heterocyclic and heteroaromatic chemistry.

CHE 5133 [credits 14]: Physical Chemistry
Pre-requisites: Recommended : Second-year Mathematics.
The introduction of quantum mechanics and the early models. Modern quantum mechanics. Quantum chemical description of relevant cases. The hydrogen atom. Multi-electron atoms. The study of molecules.

CHE 5138 [credits 14]: Analytical and Inorganic Chemistry of Natural Products
Transition metal storage, transport, and bio-mineralization. Calcium in biological systems. Biological and synthetic dioxygen carriers. Ferredoxins, hydrogenases, and nitrogenases; metal sulphide proteins. Metals in medicine. GC-MS and its analytical

applications in natural products chemistry. Electroanalytical methods: Polarography, cyclic voltammetry. UNIVEN-Visible spectrophotometry.

CHE 5230 [credits 14]: *Capita Selecta*: Analytical Chemistry
Co-requisites: CHE 5130
A detailed study of the theory and applications of selected analytical techniques, such as: Polarography and other electrochemical methods; radiochemical methods; X-ray methods; thermal analysis.

CHE 5231 [credits 14]: *Capita Selecta*: Inorganic Chemistry
Co-requisites: CHE 5131.
Occurrence and pathways of organometallic compounds in the environment. Toxicities of organometallic compounds; coordination preferences for environmental complexation by organometallic compounds. Organometallic compounds in polymers - their interaction with the environment. Environmental aspects of organolead, organoarsenic, organomercury, organotin and organosilicon compounds.

CHE 5232 [credits 14]: *Capita Selecta*: Organic Chemistry
Co-requisites: CHE 5132
Recent developments in advanced Organic Chemistry, as published internationally, such as: Modern methods of asymmetric synthesis; synthesis and biosynthesis of natural products; physical organic chemistry; orbital symmetry.

CHE 5233 [credits 14]: *Capita Selecta*: Physical Chemistry
Co-requisites: CHE 5133.
The spectra of atoms. Molecular spectroscopy. Nuclear magnetic resonance. Statistical thermodynamics: the distribution of molecular states; relating molecular properties and thermodynamic quantities.

CHE 5238 [credits 14]: Natural Products Chemistry
Classes of natural products. Biosynthetic routes. Spectrometric methods for different classes of natural products.

CHE 5300 [credits 42]: Research project
Seminars on research methodology and philosophy in Chemistry: choosing a topic, planning and executing a research project, characteristics of successful project proposals and reports. Participating in a current research project in the Department.

5.4. MASTERS (MSc) QUALIFICATIONS OFFERED IN THE DEPARTMENT OF CHEMISTRY IS ONLY BY RESEARCH

5.4.1. ADMISSION REQUIREMENTS

Qualification	Qualification Code	Duration	Admission Requirements
MSc Chemistry	MNMMSC	2 years	• A 4 years Bachelor degree or Honours degree in Chemistry with an average of 65%, an upper-second class for a class-based system with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

5.4 2. RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title and topic of the proposed dissertation, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and the Faculty Higher Degrees Committee final approval. (b) The Research proposal, registration and ethics must be approved by the Deprtments Higher Degrees Committee and then send for final approval to the Faculty Higher Degrees Committee and UHDC. (c) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the Master's degree may be conferred only after the candidate has been registered for a period of at least TWO years fulltime.

	(d) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE. (e) The Research MSc degree is conferred based on a dissertation and an examination, or a dissertation only, as determined by the Faculty Academic Board. (f) The taught MSc degree is conferred based on a mini dissertation and a component of taught modules which must all be passed as per degree requirements (g) The Head of Department may prescribe certain ancillary modules which must be enrolled or passed before the date of the Master's examination. (h) The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture. (i) SENATE may, at any time, suspend or cancel the registration of any student who, in its view, is not making satisfactory progress. (j) Students who wish to defer their studies at **any stage MUST APPLY** to the relevant department. If granted, such deferment will be for **a maximum period of one year**, after which a further application must be submitted. Deferment will, **at most**, be granted twice. (k) Before registration for 2nd or further years, the student must write a full progress report for the year passed which is signed by the supervisor and the HOD to show progress, which will be approved /not approved by the Executive Dean. This progress report will count as the last quarterly report of the passed year for the student. **No** student will be allowed to register without the approval of the Executive Dean
ASSESSMENT CRITERIA	(a) Procedures as per post-graduate policies and guidelines will be followed – this includes the agreement between the student and supervisor that must be in placed as well as the quarterly reports that must be send to the Faculty Research office as proof of student's progress (b) Quarterly progress reports are compulsory

5.5. DOCTORAL (PhD) QUALIFICATIONS OFFERED BY THE DEPARTMENT OF CHEMISTRY

5.5.1 ADMISSION REQUIREMENTS

Qualification	Qualification Code	Duration	Admission Requirements
PhD Chemistry	MNPDPC	3 years	• A MSc in Chemistry with a minimum mark of 65% OR equivalent status conferred by SENATE • Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the Department's Higher Degrees Committee concerned for recommendation to the School's Higher Degree's committee and University higher degree's committee and approval by SENATE. The Research proposal must be approved by the • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

5.5.2 PHD: RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title and topic of the proposed thesis, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and then the Faculty Higher Degrees Committee for approval. (b) The Research proposal, registration of project and ethics application must be approved by the Departments and Faculty's Higher Degrees Committee before final approval by the UHDC.

	(c) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the degree may be conferred only after the candidate has been registered for a period of at least THREE years fulltime. (d) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE.
ASSESSMENT CRITERIA	(a) Procedures as per Postgraduate policy guidelines will be followed. This will include the agreement between the supervisor and the doctoral student and the quarterly progress reports that must be submitted in time to the Faculty Research office (b) External examination of thesis will be done as per Post Graduate policies (c) Viva Voce as per school postgraduate guidelines through the office of the Executive Dean. If a student fails the Viva Voce, the degree will not be awarded. (d) Quarterly progress reports are compulsory

SECTION 6:

DEPARTMENT: EARTH SCIENCES

6.1. QUALIFICATIONS OFFERED BY THE DEPARTMENT OF EARTH SCIENCES

BSc degrees (BSc):

- Bachelor of Earth Sciences (Mining and Environmental Geology) CODE: ESBMEG
- Bachelor of Earth Sciences (Hydrology and Water Resources) CODE: ESBHWR
- Bachelor of Earth Sciences (Mine Surveying) CODE: ESMIS

BSc Hons degrees (BSc.Hons)

- Bachelor of Environmental Sciences Honours (Hydrology and Water Resources) CODE: ESHESH (HWR)

MSc degrees (MSc):

- Master of Earth Sciences (Hydrology and Water Resources) CODE: ESMMES
- Master of Earth Sciences (Mining and Environmental Geology) CODE: ESMMES

PhD degrees (PhD):

- Doctor of Philosophy (Mining and Environmental Geology) CODE: ESPMEG
- Doctor of Philosophy (Geology) CODE: ESPDGP
- Doctor of Philosophy (Hydrology and Water Resources) CODE: ESPHWR
- Doctor of Philosophy (Mining) CODE: ESPDGM

6.2. BACHELOR OF SCIENCE (BSc) QUALIFICATIONS OFFERED BY THE DEPARTMENT OF EARTH SCIENCES [CREDITS = 480]:

6.2.1. ADMISSIONS REQUIREMENTS, RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

ADMISSIONS REQUIREMENTS	(a) **Bachelor of Earth Sciences in Hydrology and Water Resources**: Matric passes at D=50% (HG) or C=60% (SG) or 60% pass in NSC in both Physical Science and Mathematics, and 50% in English. (b) **Bachelor of Earth Sciences in Mining and Environmental Geology:** Matric passes at D=50% (HG) or C=60% (SG) or 60% pass in NSC or 6 points in both Mathematics and Physical Science, and 50% in English. (c) **Bachelor of Earth Sciences in Mine Surveying:** Matric passes at D=50% (HG) or C=60% (SG) or 60% pass in NSC or 6 points in both Mathematics and Physical Science, and 50% in English. (d) **Recognition of Prior Learning:** In addition to the admission requirements for the bachelor's degree stipulated by the University, the Department of Earth Sciences will admit students based on the University RPL Policy. The Department or Schools Admission Committee will evaluate the academic background and acquired experience based on the merit of each case but strictly adhering to the University RPL Policy. The committee after evaluation will arrange either an oral or written interview for each applicant under this option if necessary. The committee may require testimonials and certificates.
RULES FOR PROGRESSION	(a) A student may only progress to the second-year level when she/he has passed 60% of the 1st year modules. (b) A student may only progress to the third-year level when she/he has passed 60% of the 2nd year modules. (c) To progress to the third-year level, a student must have passed **ALL** first- and second-year modules, unless exempted by the Excuctive Dean. (d) To progress to the Fourth-year level, a student must have passed **ALL** first, second- and third-year modules, unless exempted by the Excuctive Dean. (e) Students can register **ONLY** for modules for which **ALL** Pre-requisites have been satisfied**.** (f) To obtain a degree from the Department, students must have passed all the modules in the programme he/she is registered.
ASSESSMENT CRITERIA	(a) Continuous Assessment will consist of tests, practical, tutorials, projects, assignments and reports. (b) Students will write examinations at the end of each semester on condition that they qualify to do so. (c) The minimum final pass mark in any module is 50%. (d) To obtain the degree or diploma cum laude, a candidate must attain an aggregate of 75% or higher.

6.2.2. THE BSc QUALIFICATIONS OFFERED IN THE DEPARTMENT OF EARTH SCIENCES

Bachelor of Earth Sciences (Hydrology and Water Resources) **[CODE: ESBHWR]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**HWR 1141** (10) Intro. Hydrology & Meteorology **HWR 1142** (8) Intro. to Groundwater **ERM 1141** (12) The Natural Environment as System **MEG 1141** (10) Intro. to Geology **MAT 1143** (8) Maths for Biology, Earth and Life Sciences **CHE 1140** (16): General Chemistry **ECS 1141** (10): English Communication Skills	**8 credits taken from** **PHY 1127** (6) Physics for environmental & Agriculture	**Total: 14 modules** **Toatal creit =118 (those doing PHY)** **Total credits =130 (those doing CHE)**
	2	**HWR 1241** (10) Southern African Weather & Water Resources **HWR 1242** (8) Water Quality Principles **ERM 1241** (12) Ecological Principles for Environmental Management **MAT 1243** (8) Maths for Biology, Earth and Life Sciences **ECS 1246** (10) English Communication Skills	**CHE 1241** (10) Inorganic Chemistry I **Or** **PHY 1227** (6) Physics for environmental & Agriculture **And** **MEG 1241** (8) Intro. to Hydrogeology & Soil Science	
Year 2 **NQF Level 6**	**1**	**HWR 2141** (16) Rural Water Supply & Sanitation **HWR 2142**(16) Data Information Systems **ERM 2141**(12) Principles of Resource Management	**CHE 2121** (10) Inorganic Chemistry I **or** **MEG 2141** (12) Sedimentology, Stratigraphy & Basin Analysis	**Total: 08 modules** **Total credits (PHY) = 110credits** **Total credits (CHE) =108 credits**
	2	**HWR 2241** (16) Water Law & Institutions **HWR 2242** (16) Drought Preparedness & Management **ERM 2241** (12) Pollution & Environmental Quality	**CHE 2220** (10) Analytical Chemistry **or** **MEG 2241** (10) Intro. to Photogeology & Remote Sensin	
Year 3 **NQF Level 7**	**1**	**HWR 3141**(16) Hydrologic Measurements **HWR 3142** (16) Atmospheric Dynamics **HWR 3143** (16) Fluid Mechanics **ERM 3141** (12) Resource Evaluation & Info. Systems	NONE	**Total: 08 modules** **Total credits = 120**
	2	**HWR 3241** (16) Hydrologic Analysis **HWR 3242** (16) Hydrogeology **HWR 3243** (16) Water Quality Management **ERM 3241** (12) Env. Impact Assessment and Modelling	NONE	
Year 4 **NQF Level 8**	**1**	**HWR 4541**(16) Applied Hydrology **HWR 4542** (16) Applied Hydrogeology **HWR 4543** (16) Water Supply Systems **HWR 4990** (32) Research Techniques and Project	NONE	**Total: 07 modules** **Total credits = 128**
	2	**HWR 4641** (16) Water Resources Management **HWR 4642** (16) Applied Meteorology **HWR 4643** (16) Water Treatment Processes	NONE	

NB: Students **must** takechemistry and physics from the Department of Chemistry and Department of Physics in their first year. Chemistry continues to second year while those who are doing Physics are to continue with MEG to the end of second year.

Bachelor of Earth Sciences (Mining and Environmental Geology) **CODE: ESBMEG**

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7		Year 4 - NQF level 8	
Core Modules							
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**
MEG 1141 (10) Intro. to Geology **MEG 1142** (8) Intro. to Mining & Mineral Economics **HWR 1141** (10) Intro. Hydrology & Meteorology **ERM 1141** (12) The Natural Environment as System **ECS 1141** (10) English Communication Skills **MAT 1143** (8) Math for Life and Earth Sciences	**MEG 1241** (8) Intro. to Hydrogeology & Soil Science **MEG 1242** (10) Intro. to the Strength of Materials & Rock Mechanics **HWR 1241**(10) Southern African Weather & Water Resources **ERM 1241** (12) Ecological Principles for Environmental Management **ECS 1246** (10) English Communication Skills **MAT 1243** (8) Mat for Biology, Earth and Life Sciences	**MEG 2141** (12) Sedimentology, Stratigraphy & Basin Analysis **MEG 2142** (12) Mineralogy, Igneous & Metamorphic Petrology **MEG 2143** (12) Geochemistry & Mineral Processing **HWR 2141** (16) Rural Water Supply & Sanitation **ERM 2141** (12) Principles of Resource Management	**MEG 2241** (10) Intro. to Photogeology & Remote Sensing **MEG 2242** (8) Int. to GIS **MEG 2243** (8) Intro. to Geomedicine **MEG 2244** (10) Intro. to Surveying **MEG 2245** (8) Mine Water Generation & SA Policies & Guidelines **HWR 2241** (16) Water Law & Institutions **ERM 2241** (12) Pollution & Environmental Quality	**MEG 3141** (10) Economic Geology & Mineral Resources of SA **MEG 3142** (8) Env. Geology & Mine Rehabilitation **MEG 3143** (10) Int. to Geophysics **MEG 3144** (10) Mine Development & Mining Operations **MEG 3147** (8) Integrated Mine Water Management **ERM 3141 (**12**)** Resource Evaluation & Info. Systems	**MEG 3241** (10) Exploration & mining geology **MEG 3242** (6) Geological Field Mapping **MEG 3243** (10) Surface Mining & Mine Management **MEG 3244** (10) Surface Surveying **MEG 3245** (10) Geotechnical Engineering **MEG 3200** (6) Industrial Attachment **MEG 3246** (8) GIS & Map Production **MEG 3247** (8) Geo-environment & Health **ERM 3241** (12) Env. Impact Assessment and Modelling	**MEG 4541** (10) Mineral Exploration & Advance Mineral Economics **MEG 4542** (10) Exploration Geophysics **MEG 4543** (10) Underground Mining **MEG 4544** (10) Mine Safety and Health **MEG 4545** (10) Engineering & Transport System **MEG 4546** (10) Non-Entry Mining	**MEG 4641** (10) Hydrogeology **MEG 4642** (10) Advanced Mine & Env. Management **MEG 4644** (8) Small-Scale Mining **MEG 4647** (10) Underground Mine Surveying **MEG 4990** (30) Research Project & Dissertation
Elective Modules							
PHY 1127 (6) Physics for environmental & agricultural sciences I **Or** **CHE 1145** (12) General Chemistry for Applied Sciences	**PHY1227** (6) Physics for environmental & agricultural sciences II **Or** **CHE1223** (6) Inorganic Chemistry for the Applied Sciences **and CHE 1224** (6) Organic Chemistry for the Applied Sciences						
Total: 14 modules (PHY) = 128 credits **Total: 15 modules (CHE) = 140 credits**		**Total: 12 Modules** **Total credits = 136**		**Total: 15 modules** **Total credits = 138**		**Total: 11 modules** **Total credits = 128**	

Bachelor of Earth Sciences (Mine Surveying) **[CODE: ESBMIS]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**MIS 1241** (16) Plane Surveying 1 **MEG 1142** (8) Intro. to Mining & Mineral Economics **ERM 1141** (12) The Natural Environment as System **ECS 1141** (10) English Communication Skills	**MAT 1143** (8) Math for Life and Earth Sciences **Or** **STA 1149** (8) Basic statics **PHY 1121** (8) Mechnics	**Total: 12 modules** **MAT Total credits = 110** **STA & PHY Total Credits= 124**
	2	**MIS 1241** (16) Plane Surveying 2 **MEG 1242** (10) Intro. to the Strength of Materials & Rock Mechanics **ERM 1241** (12) Ecological Principles for Environmental Management **ECS 1246** (10) English Communication Skills	**MAT 1243** (8) Math for Life and Earth Sciences **Or** **STA 1249** (8) Basic statics **PHY 1221** (8) Mechnics	
Year 2 **NQF Level 6**	**1**	**MIS 2141** (16) GPS and Astronomy **MIS 2142** (16) Cartography **MIS 2143** (12) Law of Real Property **ERM 2141** (12) Principles of Resource Management	**NONE**	**Total: 09 modules** **Total credits = 138**
	2	**MIS 2241** (18) Engineering Surveying 1 **MIS 2242** (18) Surveying Computation & adjustment 1 **MIS 2243** (18) Computer Aided Cartography **MEG 2244** (10) Intro. to Surveying **MEG 2242** (8) Int. to GIS **ERM 2241** (12) Pollution & Environmental Quality	NONE	
Year 3 **NQF Level 7**	**1**	**MIS 3144** (20) Geodesy **MIS 3146** (20) Advanced Engineering Surveying **MEG 3144** (10) Mine Development & Mining Operations **ERM 3141** (12) Resource Evaluation & Info. Systems	NONE	**Total: 11 modules** **Total credits = 120**
	2	**MIS 3209** (12) Industrial Attachment **MEG 3242** (6) Geological Field Mapping **MEG 3243** (10) Surface Mining & Mine Management **MEG 3245** (10) Geotechnical Engineering **MEG 3246** (8) GIS & Map Production **ERM 3241** (12) Environmental Impact Assessment and Modelling	NONE	
Year 4 **NQF Level 8**	**1**	**MIS 4546** (20) Cadastral Surveying **MEG 4545** (10) Engineering & Transport System **MEG 4544** (10) Mine Safety & Health **MIS 4990** (35) Research Project & Dissertation	NONE	**Total: 07 modules** **Total credits =113**
	2	**MIS 4647** (20) Underground Surveying **MEG 4642** (10) Advanced Mine & Env. Management **MEG 4644** (8) Small-Scale Mining	NONE	

6.2.3. DESCRIPTION OF UNDERGRADUATE MODULES OFFERED BY THE DEPARTMENT OF EARTH SCIENCES PER SEMESTER

6.2.3.1 MAJOR MODULES IN THE BACHELOR OF HYDROLOGY AND WATER RESOURCES

FIRST YEAR MODULES – SEMESTER 1:

HWR 1141 : Introductory Hydrology and Meteorology [Credits 10]
Module Content : Definition and scope of hydrology as an area of study; the hydrologic cycle; energy transformations and the water budget equation; the catchment and human interference; precipitation as a process; types of precipitation; artificially induced precipitation; measurement of precipitation; effective depth of precipitation; potential and actual evapo-transpiration and their measurements; factors influencing evaporation; increased water supplies through reduced evaporation; the runoff process; measurement of streamflow; the infiltration process; soil moisture, moisture storage and measurement; factors and elements of climate; impact of people on climate and the influence of climate on historical events; the atmosphere, its structure and composition; radiation, temperature, pressure, wind, humidity, precipitation, clouds, air masses and fronts; measurements; weather maps.

HWR 1142 : Introduction to Groundwater [Credits 8]
Module Content : Definition of hydrogeology; origin and occurrence of groundwater; porosity and hydraulic conductivity of earth materials; geologic formations as aquifers; types of aquifers; the water table and piezometric surface; definition of the terms hydraulic head, hydraulic gradient, transmissivity, storage coefficient, specific yield and groundwater reserve; introduction to the fundamental principles of groundwater movement; Darcy's law and its application; borehole and well design, siting, construction and operation; groundwater quality and pollution.

FIRST YEAR MODULES – SEMESTER 2:

HWR 1241 : Southern African Weather and Water Resources [Credits 10]
Module Content **:** Weather and climate in relation to the physical structure of the atmosphere, radiation in the atmosphere, radiation laws, cloud micro-physics and precipitation processes; factors of climate and climatic classification; regional distribution of climate around the world; seasons and weather in southern Africa; introduction to the analytical methods of climatology; nature and extent of the major surface-water and groundwater basins in southern Africa; introduction to cross-border water resources issues in the region; South Africa's water sources and their quality and availability, including rainwater as a resource.

HWR 1242 : Water Quality Principles [Credits 8]
Module Content **:** The importance of water chemistry and microbiology in the management of water quality; units of chemical measurement; types of chemical reactions in water; redox reactions; gas and mass transfers; law of mass action; ionization and ion exchange; introduction to isotope hydrology; physical, chemical and microbial characteristics of water; water sampling techniques, laboratory and field analyses of physical, chemical and microbiological characteristics of water; fundamental principles of the microbial transformations of matter in natural processes and in biological treatment systems; South African's guidelines (SABS) for the physical, microbiological and chemical quality of drinking water and aquatic ecosystems, within the context of the global guidelines of the World Health Organization (WHO) and possibly USEPA.

SECOND YEAR MODULES – SEMESTER 1:

HWR 2141 : Rural Water Supply and Sanitation [Credits 16]
Module Content **:** The role of water in the community; the role of community in the water sector forum and planning meetings; water, sanitation, hygiene and human health; participatory planning and management of user-choice schemes; integrated development plan regional and strategic infrastructure planning; alternative rural water supply sources and selection of source; roof and ground catchments of rainwater, their storage and quality preservation; tapping gravity and artesian springs; methods of groundwater withdrawal, including dug wells and infiltration galleries; typical stream-water intake structures, small dams and village ponds; pumps for raising water, including hand-pumps, wind-pumps, hydraulic rams and solar pumps; common water treatment methods; water transmission, storage and distribution; technical and economic options of sanitation systems; participatory hygiene education.

HWR 2142 : Data Information Systems [Credits 16]
Module Content **:** General data considerations in hydrology and water resources, their evaluation and associated data processing; introduction to computer hardware and software; data types and functional requirements for database management; basic statistical concepts for analysis and applications of statistical packages in the analysis

of hydrological and water resources data; elementary numerical methods and their applications relevant to hydrology and water resources; use of computer software in the analysis of water resource survey data**.**

SECOND YEAR MODULES – SEMESTER 2:

HWR 2241 : Water Law and Institutions [Credits 16]
Module Content **:** Legal concepts and the legal framework relating to water as a resource; the property of water and the right to use; regulation of the quantity of surface-water and groundwater; protection of water quality; definition of the concepts and issues in the management of the resource; Water Policy and Law in South Africa; traditional institutional arrangements and alternative institutional structures; decentralization and user participation in technical, financial and administrative operations.

HWR 2242 : Drought Preparedness and Management [Credits 16]
Prerequisite **:** *HWR 1241*
Module Content **:** The concept of drought; frequency and causes of drought; different types of drought; local, regional and global climate variability; climate-related disasters, emphasizing droughts and wind erosion; major drought-afflicted areas; impacts of droughts on water availability and water uses; vulnerability and adaptability to drought; agricultural production in arid and semi-arid zones; long-term planning and early warning systems; drought monitoring and analysis; mitigation measures, possibility of cloud seeding and rehabilitation and mitigation activities; local capacity building for community-level preparedness for, and management of, drought; and local and global reactions.

THIRD YEAR MODULES – SEMESTER 1:

HWR 3141 : Hydrologic Measurements [Credits 16]
Module Content **:** Hydrometric gauging networks and design considerations; rainfall storage gauges and rainfall recorders; siting the rain-gauge; radar measurement; interpretation of precipitation data and estimation of missing data; double mass analysis; depth-area and depth-area-duration analyses; global geographic variations in precipitation; factors affecting evaporation and transpiration; measurement and computation of reservoir evaporation, transpiration and potential evaporation; stream gauging using manual and recording methods; current-metre measurements of discharge and computations; dilution gauging, modern gauging techniques; stage-discharge relationships and extension of rating curves; soil moisture retention, movement and measurement.

HWR 3142 : **Atmospheric Dynamics [Credits 16]**
Prerequisite : *HWR 1141*
Module Content **:** In-depth treatment of gas laws; hydrostatic equation and its application, equations of motion on rotating earth (including coriolis force, geostrophic wind, and gradient wind), thermal wind equation and thickness relation; atmosphere thermodynamics and stability; cloud dynamics and adiabatic charts; planetary and secondary circulation; jet streams; vorticity; cyclogenesis; meteorological instruments and their operations; weather maps and data exchange; codes and plotting of charts.

HWR 3143 : Fluid Mechanics [Credits 16]
Module Content **:** Physical properties of water; hydrostatic pressure and forces; measurement of pressure differences, hydrodynamic concepts including continuity and Bernoulli principles and their applications; flow in pipes and resistance to flow; total head losses and energy gradient lines; closed pipe flow measurements; flow in pipe networks.

THIRD YEAR MODULES – SEMESTER 2:

HWR 3241 : Hydrologic Analysis [Credits 16]
Prerequisite : *HWR 3141*
Module Content **:** Relationships between precipitation and runoff; surface retention and runoff mechanisms and components; estimation of the volume of storm runoff; hydrograph analysis and separation; the concept of the unit hydrograph and its derivation; conversion of the unit hydrograph duration; application of unit hydrographs; waves in natural channels and their movement; non-storage routing; flood routing through level-pool reservoirs and river channels; hydraulic routing, its governing equations and numerical solution techniques; types of deterministic models; conceptual catchment modelling; model input parameters, calibration and predictive simulation; limitations of the modelling process.

HWR 3242 : Hydrogeology [Credits 16]
Prerequisite : *HWR 1142*
Module Content **:** Groundwater occurrence; properties of aquifers and their determination; heterogeneity and anisotropy as aquifer characteristics; Darcy's Law and its applicability; equations describing groundwater

movement; flow lines and flow nets; equilibrium and non-equilibrium hydraulics of wells; geological, GIS, remote sensing and geophysical field investigation techniques; hydrogeologic site evaluation; aquifer potential, its safe yield, artificial recharge, and the possibilities of saline intrusion and subsidence; groundwater model types and their use and misuse; water well drilling, completion and development; groundwater regions of South Africa; groundwater resource protection.

HWR 3243 : Water Quality Management [Credits 16]
Prerequisite : *HWR 1242*
Module Content **:** Chemical, physical and microbiological characteristics of water and wastewater; water quality variables and monitoring; water quality requirements; erosion and sediment yield; solute transport; types, sources and classification of pollutants; legal and institutional framework for water pollution control; local and global standards, regulations and management practices; public health and environmental impacts of water pollution; pollution remediation, surface-water and groundwater quality modelling.

FOURTH YEAR/HONOURS MODULES – SEMESTER 1:

HWR 4541/5541 : Applied Hydrology [Credits 16]
Prerequisite : *HWR 3241*
Module Content **:** Probability distributions, parameter estimation and probability plotting; probability as a hydrologic planning tool; probability of hydrologic events, including flood, runoff volume and precipitation; derivation of return period and regional flood frequency; hydrologic time series; time series analysis and synthesis, and their application; stochastic analysis of rainfall and streamflow; reservoir siting and yield analysis, practical problems in hydrologic practice, including floodplain mapping and flood regulation, and the design of urban storm drainage, highway culverts, spillways and cooling ponds.

HWR 4542/5542 : Applied Hydrogeology [Credits: 16]
Prerequisite : *HWR 3242*
Module Content **:** Principles of groundwater flow; solutions to equations of flow in confined and unconfined aquifers; computation of drawdown due to well pumping in various aquifer settings; determination of aquifer parameters from time-drawdown data under steady-state and non-equilibrium flow conditions; effect of partial well penetration; regional groundwater flow systems under steady-state and transient conditions; computation of travel time for pollutants in groundwater; groundwater management; surface-groundwater interactions; groundwater modelling and types of published numerical simulation models; finite difference and finite element approaches; data requirements and the accuracy of models; application of groundwater models; general application of hydrogeology to human concerns.

HWR 4543/5543 : Water Supply Systems [Credits: 16]
Prerequisite : *HWR 3141*
Module Content: Water uses and quantities; water characteristics, quality and treatment; bulk water supply systems, siting and zoning; water demand and design period; types of water transmission conduits; transmission design considerations and hydraulic design; water transmission by pumping; types of distribution systems; design considerations and distribution system design; pipe materials for transmission and distribution; leak detection and control; software packages for design and simulation.

FOURTH YEAR/HONOURS MODULES – SEMESTER 2:

HWR 4641/5641 : Water Resources Management [Credits 16]
Module Content **:** Traditional institutional approach of fragmented water resources management; principles of integrated water resources management as a comprehensive approach to resource management; conjunctive use schemes; rainfall partitioning; catchment planning and management processes; water allocation; social, institutional, environmental and financial considerations; calculation of demand (rural, urban and environmental), demand management; water as an economic good and pricing of urban and peri-urban water; market conditions and failures, and public policy in resource management; competing uses of water; conflict resolution; private sector participation; conditions and challenges in managing the resource; key elements of integrated management emphasizing inter-generational and intra-generational equity (sustainability); privatization and user stakeholder participation in resource management; case studies, especially from the southern Africa region; transboundary issues (conventions, treaties and protocols).

HWR 4642/5642 : Applied Meteorology [Credits 16]
Prerequisite : *HWR 3142*
Module Content **:** Principles of radar operation and radar remote sensing techniques; types of radar and their applications in meteorology; use of atmospheric data and cloud imagery from satellites for understanding the atmosphere and for weather forecasting.

HWR 4643/5643 : Water Treatment Processes [Credits 16]
Prerequisite : *HWR 3243*
Module Content **:** Water storage and offtake structures; water aeration, chemical precipitation and ion exchange; storage, preparation and dosing of reagents; rapid and slow mixing; coagulation and flocculation; sedimentation; rapid and slow sand filtration; removal of dissolved organic and inorganic solids through ion exchange, membrane technologies, adsorption and chemical oxidation; water stabilization; treatment, disposal and reuse of backwash water and sludge; operation and management of water treatment plants; community-level water purification on a domestic scale; disinfection and decontamination of aquifer.

6.2.3.2 MAJOR MODULES IN THE BACHELOR OF EARTH SCIENCES IN MINING AND ENVIRONMENTAL GEOLOGY

FIRST YEAR MODULES – SEMESTER 1:

MEG 1141 : Introduction to Geology [Credits 10]
Module Content **:** The nature and scope of geology, nature of the universe and the solar system, theories on the formation of the earth, internal structure of the earth, earth materials, earth processes, structure and composition of the earth, economic importance of selected mineral, plate tectonics, geological structures, basic principles of stratigraphy, types of stratigraphy. Practical: Identification of minerals, identification of rocks, map interpretation, drawing of geological section and reading and understanding of simple geological maps.

MEG 1142 : Introduction to Mining & Mineral Economics [Credits 8]
Module Content **:** Introduction to mining – basic principles of mining; mining terms and safety; mining techniques and the history of mining; significance of mining; underground versus open pit mining; infrastructure needed by mines; environmental problems of mining. Introduction to mineral economic: Classification of mineral commodities, mineral resources and reserves, energy resources, physical and social infrastructure, taxes, tariffs and incentives, mineral processing, company mineral policies, national mineral policies, mineral marketing, trade and pricing, monopolies, cartels, embargoes and stockpiles, forecasting in the mineral industry, commodity studies.

FIRST YEAR MODULES – SEMESTER 2:

MEG 1241 : Introduction to Hydrogeology & Soil Science [Credits 8]
Module Content **:** Hydrogeology: principles of water movement and storage; permeability, porosity, classification of aquifers; groundwater flow, velocity and barriers; classification of South Africa's aquifers; quality of groundwater; groundwater exploration, role of geology and the use of geophysics; drilling methods; evaluation of groundwater potential (quality and quantity); groundwater in mines. Soil Science: soil and soil formation; rock weathering; products of weathering; soil formation and soil profiles; soil properties; soil physics and chemistry; colloidal fraction of soil; the organic and biological fractions; soil conditioner, physical problems of soils; soil classification and use; soil types in South Africa; engineering classification of weathered rock and soils; weathering grade and rock properties; engineering properties of soils.

MEG 1242 : Introduction to the Strength of Materials & Rock Mechanics [Credits 10]
Module Content **:** Strength of materials – mechanical properties of materials; analysis of stress; triaxial stress; Mohr's representation of stress. Theories of failure; elastic strain energy; fatigue strength; theory of elasticity. Laboratory test of materials behaviour and mechanical properties, stress-strain measurements; experimental analysis of tension, instruments and measuring devices. Rock mechanics: Concepts of rock mechanics; and earth materials. Rock behaviour and properties (strain and stresses properties of rocks), types and source of stresses, plastic and elastic behaviour of rocks, excavation design in elastic rocks. Rock mass characteristics: major types of structural features; geo-mechanical properties of discontinuities and collection and interpretation of structural data. Rock mass failure criteria. Rock mass classification: nature and use of rock mass classification scheme, rock behaviour in different tests. Effects of excavation on rock mass. Rock supporting and reinforcement material.

SECOND YEAR MODULES – SEMESTER 1:

MEG 2141 : Sedimentology, Stratigraphy & Basin Analysis [Credits 12]
Pre-requisite : *MEG 1141*
Module Content **:** Sedimentology – Rock cycle, weathering and types of weathering, types of sediments, erosion and transportation of sediments, deposition, diagenesis. Types of sedimentary rocks: clastic sedimentary rocks and classification, sandstones, conglomerates, mudrocks: chemical sedimentary rocks: evaporites, carbonates, other chemical sedimentary rocks. Basin analysis. Stratigraphy: Stratigraphic classification; lithostratigraphy units, principles of stratigraphy, stratigraphic sections, unconformities, Walther's Law of Facies, transgressions and regressions, biostratigraphy units, index fossils, problems in biostratigraphy, magnetostratigraphy units, earth's magnetic field, normal or reversed polarity: chronostratigraphic units, chronostratigraphy and geochronology, the

geologic time scale, subdivision of chronostratigraphic units, stratigraphic correlation, paleoenvironment: absolute age dating techniques, radiocarbon dating, radioactive dating, dendrochronological dating.

MEG 2142 : Mineralogy, Igneous & Metamorphic Petrology [Credits 12]
Pre-requisite : MEG 1242
Module Content **:** Mineralogy – Fundamentals of mineralogy, chemical elements, chemical bonding, crystal structure, crystallography, and crystal growth. Mineralogical principles such as isostructuralism and polymorphism. Mineral stability, solid solution, exsolution and phase diagrams. Physical and optical properties of minerals, Identification techniques using hand specimen, microscopy and geochemical methods. Importance of physical, chemical and optical properties of rock forming minerals in the classification of groups of rock forming minerals and the formation of rocks (igneous and metamorphic). Igneous petrology: igneous structure and textures, chemistry and mineralogy of igneous rocks, classification of igneous rocks, phase rule and phase diagrams, petrogenesis, movement and modification of magmas, basalts and ultramafic volcanic rocks, rhyolites and pyroclastic rocks, andesite, ultramafic intrusive rocks, granodiorites, granites and pegmatites, alkaline igneous rocks, composition of meteorites and variation diagrams. Metamorphic petrology: Metamorphism and metamorphic rocks, textures and structures, metamorphic conditions, mineralogy, protoliths, facies, and facies series, metamorphic phase diagram, Low to medium P/T metamorphism facies, High P/T metamorphism facies, Eclogites, Dynamic metamorphism.

MEG 2143 : Geochemistry & Mineral Processing [Credits 12]
Pre-requisite : *MEG 1142*
Module Content **:** Geochemistry – Definitions; physical properties of minerals; systematic mineralogy; main groups of silicate minerals; fundamental laws of chemistry; crystal chemistry; rules governing atomic substitution; structure and composition of the crust, mantle and core; geochemical classification of the elements; element associations in key ore deposit types; geochemical composition of igneous, metamorphic and sedimentary rocks; normative composition; phase diagrams; partitioning of trace elements during magmatic processes; distribution of trace elements in sedimentary and metamorphic rocks; mobility of elements in the surface environment; applications of mineralogy and geochemistry; isotope geochemistry; biogeochemistry; organic geochemistry; regional and environmental geochemistry. Mineral processing: mineral liberation by crushing, grinding, screening, and classification. Mineral concentration using gravity, dense medium, magnetic and high-tension separators. Froth flotation and flotation circuits. Use of reagents - collectors, frothers, depressants, and activators. Precious metals recovery methods - cyanidation, carbon-in-pulp, carbon-in-leach, metal recovery methods. Heap leaching technology for precious metals and base metals. Dewatering techniques - thickening, filtering, drying, flocculants, and filter aids. Flowsheet analysis. Material balances. Measures of efficiency of mineral separations.

SECOND YEAR MODULES – SEMESTER 2:

MEG 2241 : Introduction to Photogeology & Remote Sensing [Credits: 10]
Pre-requisite : *MEG 1241*
Module Content **:** Photogeology - Electromagnetic spectrum and image characteristics; aerial photographs- types, handling and ordering; geometrical properties of aerial photographs; use of stereopairs and stereoscopes; elements of aerial photographs interpretation; direct and indirect ways of interpreting geological structures and lithologies from aerial photographs. Remote sensing - Basic concepts of remote sensing, remote sensing systems, properties of electromagnetic energy. Atmosphere scattering (Mie and Rayleigh scattering processes). Wavelength regions and bands. Types of resolution of satellite images/systems (spatial, spectral, radiometric, and temporal resolutions). Mosaic (analogue and digital mosaics). The structure of digital images. Image analysis, digital image analysis. Overview of image processing (image restoration, image enhancement, image transformation). Image classification (supervised and unsupervised classification).

MEG 2242 : Introduction to GIS [Credits 8]
Module Content **:** Geographical Information Systems (GIS) – Definition and application of GIS. Spatial data and attribute data. Georeferencing and map attributes. Map scale and projections, coordinate systems. Spatial data analyses: query, reclassification, buffering and neighbourhood analysis, integrating data-map overlay, spatial interpolation, analysis of surface, and network analysis, edge matching and robber sheeting. GIS Data Model: vector and raster data model. Getting the map into the computer: digitizing and scanning, field and image data. Database management: search by attribute and geography, query interface. Map production with GIS: map attributes, types of maps, designating the map. *Practical:* Use of ArcGIS for data processing; GIS based geological map production (ArcGIS); Interpretation of spectral signatures of different earth materials.

MEG 2243 : Introduction to Geo-medicine [Credits 8]
Module Content **:** Definitions, concepts, history and scope. The geochemical circulation of nutritional and toxic elements. Health risk exposure pathways; dose-response curves. Essential elements and their deficiency and excess: Iodine deficiency disorders (IDD); role of goitrogens in I activity and elimination of IDD. Public health conditions attributed to fluoride deficiency/excess; defluoridation techniques. Arsenic and dermatosis; psoriasis.

The role of Se as a co-factor in HIV-AIDS diffusion, Keshan disease, Kashin-Beck disease, and cancer. Distribution and mining of uranium in Africa; natural radiation emission and radon gas. Mercury emission in small-scale gold panning and health effects. Cardiovascular disease, cancer and the geochemical environment. Geophagia, Kaposi's sarcoma and podoconiosis. Endomyocardial fibrosis Mseleni joint disease (MJD). Volcanic gas chemistry, health spas and mineral waters. Balneology of peat deposits. The African dust plume: sources, composition, propagation and health effects. The health impact of mining and mineral processing; geogenic dust (silicosis, tuberculosis, coal workers pneumoconiosis and asbestosis); health effects of leachates, emissions and other waste from mining; acid mine drainage. Health and the geology of energy. Trace elements in soils and plants: implications for wildlife nutrition. Environmental epidemiology. Environmental and medical data sources. Analytical techniques in environmental geochemistry. Africa geochemical database. Medical Geology in Africa: Future perspectives and prospects

MEG 2244 : Introduction to Surveying [Credits 10]
Module Content **:** History of Surveying; classification of surveying according to purpose, methods and instruments; chain surveying principles and methods; use of basic surveying instruments. Compass traversing: use of prismatic compasses, magnetic bearing, magnetic declination, whole circle and quadrant bearing and errors affecting compass observations. Height determination by spirit levelling. Practical: survey of a plot of land by chain and compass; graphical adjustment of compass surveying; computational adjustment of traverse by Bowditch's rule; conversion of map distance to ground distance and vice versa.

MEG 2245 : Mine Water Generation and South African Policies & Guidelines [Credits: 8]
Module Content **:** Mine water – Types/classifications of mine water; extent of water contamination from mines, factors influencing water contamination; negative impacts of water contamination at mine sites; types of water pollution from mining; beneficial uses of mine water; principles of water quality management; water quality management instruments; and water quality monitoring. Policies and guidelines: Aims, objectives, purpose and principles of the National Water Act; Water Services Act; water use license and types of water use authorisations.

THIRD YEAR MODULES – SEMESTER 1:

MEG 3141 : Economic Geology & Mineral Resources of Southern Africa [Credits 10]
Pre-requisite : *MEG 2142*
Module Content **:** The principal ore minerals and their identification. The mineralogy, morphology and origin of the major types of mineral deposit, industrial minerals, coal, petroleum and natural gas. The periodic table; Goldschmidt's classification of the elements. Classification: association of elements in ore deposits. Plate tectonics and the global distribution of ore deposits. Occurrence and mode of formation of ore deposits. Igneous, Sedimentary and Metamorphic deposits. Hydrothermal deposits (mesothermal lode gold deposits; epithermal stockwork vein deposits). IOCG (iron oxide, copper, gold) deposits. Archaean conglomerate hosted gold-uranium deposit: sole example is Witwatersrand. Porphyry copper deposits. Carbonatite, alkaline igneous-related deposits. Banded Iron Formation iron ore deposits. Mississippi Valley-Type (MVT) zinc-lead deposits. Epigenetic deposits, syngenetic deposits, sedimentary exhalative deposits, volcanogenic massive sulphide deposits, placer deposits, lateritic deposits, etc. Case study of classic ore deposits with emphasis on Southern African and South African mineral deposits.

MEG 3142 : Environmental Geology & Mine Rehabilitation [Credits 8]
Pre-requisite : *MEG 2141*
Module Content **:** Environmental geology – The scope of environmental geology: Metallic, non-metallic, and industrial minerals. Renewable and non-renewable energy resources. Hydrocarbons: Petroleum, coal, natural gas and greenhouse gas emissions. Geochemical distribution of elements in the geosphere. Pathways of nutritional and toxic elements into the food chain; health implications. Chemistry and pollution of natural waters, soils and air; point and non-point sources of pollution; economics of environmental degradation. Geogenic dust and other emissions from ore processing operations; the ozone layer; acid rain. Geo-hazards: volcanism, earthquakes, landslides, mud-pools, potholes, floods (avalanche). Geological aspects of waste disposal. Climate change impacts on geological processes and management of the African coastal zone. Mine rehabilitation: Environmental challenges of mining: Air and water quality issues, land disturbance, social impacts. Minesite rehabilitation – Objectives of rehabilitation; benefits of progressive rehabilitation; planning, components, methods and techniques of mine rehabilitation; rehabilitation project feasibility studies; criteria for assessing rehabilitation alternatives; development and content of rehabilitation plan.

MEG 3143 : Introduction to Geophysics [Credits 10]
Pre-requisite : *MEG 2242*
Module Content **:** Introduction – Geophysics and its role in exploration; physical properties of the target and the host rocks; geophysical exploration methods and techniques. Magnetic method: magnetic properties of rocks and minerals; geomagnetic field; airborne and ground magnetic surveys, reduction of magnetic data, processing of magnetic data, data enhancement: presentation of magnetic map, interpretation of magnetic anomaly map.

Electrical method: electrical conductivity in minerals and rocks; electrical resistivity survey; electrical resistivity equipment; presentation and interpretation of field data, application of electrical sensitivity method. Self-potential method; electro-kinetic potential; liquid junction potential; shale potential; mineralization potential; self-potential field equipment; interpretation of self-potential data; application of self-potential method. Polarization method: IP parameters; chargeability, spectral IP; source of the IP effect; membrane polarization; time and frequency domain IP; frequency effect and metal factor in IP Survey; phase shift and phase compensation; IP Equipment; interpretation of combined IP and resistivity data; application of IP method. Electromagnetic method: Principles of EM method; EM equipment; primary and secondary fields; frequency and time domain EM systems; measurement of apparent resistivity, conductivity measurement.

MEG 3144 : Mine Development & Mining Operations [Credits: 10]
Pre-requisite : *MEG 2143*
Module Content **:** Land acquisition and environmental impact assessment; mine planning and design; primary and secondary development; drilling techniques and rock penetration; chemistry and properties of explosives; blasting methods/patterns and rock fragmentation; design and support of underground openings; mine transport; haulage and hoisting; auxiliary operations – ventilation, drainage; mine management and security. Practical: Exercises in mine planning and design and unit mine operations.

MEG 3147 : Integrated Mine Water Management [Credits 8]
Pre-requisite : *MEG 2245*
Module Content **:** Evolution of mine water management in South Africa; Environmental sound water management; Legal framework; Mining, water and environmental legislation in South Africa; Policies, strategies and guideline documents that govern water management in South Africa; Causes of water pollution: Point and non-point pollution; Water management areas in South Africa, Water management hierarchy: Pollution prevention, storm water management, Water reuse and reclamation; overview of Water treatment and discharge, pollution prediction from mining sites; water and salt balances; water monitoring system; Integrated water quality management (IWQM)model; Plan, do, act and check system; Principles of integrated mine water management: Compliance with water management decision-taking hierarchy, Life cycle approach, Plan for closure, Cradle to grave principle, Precautionary principles; Water conservation and water demand management (WC/WDM); Consideration of temporal variation of water quality and quantity; Risk-based approach; Continual improvement management commitment and Integrated mine water and waste management plan (IMWWP).

THIRD YEAR MODULES – SEMESTER 2:

MEG 3241 : Exploration & Mining Geology [Credits 10]
Pre-requisite : *MEG 2142*
Module Content **:** Identification of target minerals – key stages of mineral exploration process; area selection; criteria controlling the choice of sites for geological prospecting; field documentation and basic field procedures; geological logging; mineralogical, structural, stratigraphical and geomorphological guides to ore search. Exploration techniques: Geological surveying or sampling of rocks; limitations and applications of various exploration methods; principle, types, origin, instruments, field procedure and interpretations of exploration methods. Theory and field procedures of geochemical exploration; sampling of stream sediments for geochemical analysis; application of geochemistry in mineral exploration – explorations for gold, copper and base metals. Ore reserve estimation techniques: Reserves and resources; theories and review of elementary statistics; methods and applications of traditional ore reserves estimation techniques; merits and drawbacks of various estimation methods and relevance to specific mineral deposit types; use of computers in ore reserve estimation; volume/tonnage and grade calculations; problems relating to evaluation of ore reserves.

MEG 3242 : Geological Field Mapping [Credits 6]
Module Content **:** Mapping of specified areas by groups of students. The use of aerial photographs and topographic maps in obtaining geological information. Use of field equipment. Description of rocks from outcrops and hand-specimen. Collation of attitude data. Identification and description of geological structures. Construction of geological map from the data gathered during actual field work. Construction of the cross section. Scanning and digitizing of manually constructed geological map. Writing a scientific report that covers lithological description, lithostratigraphy (also biostratigraphy if applicable), paleoenvironment and economic considerations of the selected area.

MEG 3243 : Surface Mining & Mine Management [Credits 10]
Module Content **:** Surface Mining – comparison of surface and underground mining, classification of surface mining methods; mine planning and design; surface mine development; surface mine infrastructure; surface mining methods including open pit mining, open cast mining, quarrying, augering; highwall mining, hydraulicking, dredging, borehole mining, and leaching; comparison of surface mining methods. Surface mine rock drilling and blasting; surface mine material handling equipment; mine dewatering and auxiliary operations. Mine Management: key functions of management; management processes; types and elements of mine planning; management by

objectives; characteristics, advantages and limitations of various types of organizational structures; centralisation and decentralisation; managerial leadership; decision-making and process of delegation; motivation and Maslow's Hierarchy of Needs and its applications. Practical: Design and planning of surface mining operations, calculations involving stripping ratios and pit limits, mining cost estimation, and review of mine management case studies.

MEG 3244 : Surface Surveying [Credits 10]
Pre-requisite : *MEG 2244*
Module Content **:** Theory of traversing – open, closed, and link traverses; computation of traverse coordinates; determination of areas and volumes. Tacheometry: Subtense and stadia. Determination of distances by chain and Electromagnetic Distance Meter (EDM). Theory of error and adjustments. Concepts of standard error and standard deviation, rejection criteria. Method of Least Squares and Application. Transformation of plane coordinates. Elementary field astronomy and photogrammetry; GPS surveying. Practical: Detailed application of compass and theodolite for traversing. Use of planimeter to determine areas. Tacheometric surveying for spot heights. Use of Level Instruments for determination of elevation and contouring observation of azimuth by topographical method photo-identification, use of parallax bar for height determination.

MEG 3245 : Geotechnical Engineering [Credits 10]
Module Content **:** Soil mechanics: permeability and seepage, effective stress principle, consolidation, compaction, shear strength. Geotechnical site investigation: Principles, objectives and rationale of site investigation; stages of site investigation programme, design and implementation; laboratory and field-based methods. Stability of slopes: geological appraisal of slope behaviour; types and mechanics of slope failure; factors affecting slope stability; slope stability analysis. Rock mechanics: Definition of terms and importance of rock mechanics; classification and index properties of rocks; classification of rock masses for engineering purposes; rock strength and Failure Criteria Modes of failure of rocks; static and dynamic methods of rock testing in the laboratory.

MEG 3246 : GIS & Map Production [Credits 10]
Pre-requisite : *MEG 2242*
Module Content **:** Introduction to GIS, components of GIS, spatial and non-spatial queries and its applications; Spatial and non-spatial data and models in GIS; Vectors and Raster models, their advantages and disadvantages, intro ARCView GIS; Attribute tables and data (Entity, Objects and Data models); Measurement scale; Data organization; Geodatabase; a Database Management System (DBMS) ; Relational Database Management System (RDBMS); Primary key and foreign key; Feature classes; Feature datasets; Topological relationship; Building relationship between Features and Tables. Database management: Spatial data analysis; search by attribute and geography, query interface (SQL (Structured Query Language); Boolean algebra, General arithmetic operations; General statistical operations; Geometric operations); Classification and reclassification and overlay and display; Special interpolation; Data capture; Getting the map into the computer: digitizing and scanning, field and image data. Map projects in GIS; Coordinate conversion; Geometric distortions Global positioning system (GPS); Map production with GIS: map attributes, types of maps, designating the map (georeferencing); Spatial data analysis; Edge matching and rubber sheeting; GIS Data Quality; Source of inaccuracies and impression (obvious sources or errors, errors from natural variations or from original measurement, errors. *Practical:* Use of ArcGIS for data processing; GIS based geological map production (ArcGIS); Interpretation of spectral signatures of different earth materials.

MEG 3247 : Geo-Environment and Health [Credits 8]
Pre-requisite : *MEG 2241*
Module Content **:** Diseases and geo-chemical environment; Geo-chemical circulation of nutrients and toxic trace elements; Impacts of mining and mineral processing on human health: Hg, As, Pb, Si and Cd poisoning; Bio-accessibility and bioavailability of toxic elements in soils, plants, water, humans and animals. Identification of geo-environmental impacts- levels of main and trace elements; geological emissions: volcanic ash and gases, radon gas, geothermal emissions and geysers; physiological functions of macro/micro elements; geology-water-food chain diseases: fluorosis, Se and As poisoning and Iodine Deficiency Disorders (IDD). Practical: Field assessment within the community to identify possible signs of health problems related to mining and geo-environment.

MEG 3200 : Industrial Attachment [Credits 6]
Module Content **:** Training at an approved practical training placement site in all aspects of mining including geology, surveying, mine planning, surveying, material handling, mineral processing, community services, supervision and administrations. The training forms an integral part of the cooperating organization's philosophy and practice and is to be of benefit to the organization's productivity, revenue, and staffing goals. Close communication with the students is a major factor in good training. In this regard, students are assigned supervisor/mentor to maintain close contact with the student's progress and respond directly to any concerns that may arise. At the end of the training, the reporting supervisor of the student in the company provides feedback on the student's performance. Writing of technical report on training experience is an essential component of the training programme.

FOURTH YEAR MODULES – SEMESTER 1:

MEG 4541 : Mineral Exploration and Advanced Mineral Economics [Credits 10]
Pre-requisite **:** *MEG 3141*
Module Content **:** Mineral exploration – principles and methods; precious metals and minerals – classification and exploration; metallic ore deposit geology and exploration techniques; industrial minerals classification and exploration; exploration budget and management; feasibility studies for mine development of small mining enterprises. Mineral economics: importance of minerals in national economy; mineral resources availability; determinants of demand for mineral commodities; resource curse; mineral taxation, tariffs and incentives; mineral market structure; rent seeking; theory of depletion, company and national mineral policies; monopolies, mineral cartels, embargoes and stockpiles; forecasting in the mineral industry; mining feasibility studies; investment in minerals sector; and opportunity and risk.

MEG 4542 : Exploration Geophysics [Credits 10]
Pre-requisite : *MEG 3143*
Module Content **:** Refraction seismic method – basic principles of refraction seismic; time, distance relationship; propagation of elastic waves beneath two-layer medium; propagation of seismic waves through three-layer earth; propagation through dipping layers. Field procedure: instrumentation; data acquisition; and data reduction and interpretation. Application of resistivity method for hydrogeological investigation, mineral exploration (Barberton Greenstone belt, the Wits and Karoo basins). Gravity method: data reduction and processing; presentation and interpretation of gravity anomaly map; isostasy; practical examples: gravity survey in the Bushveld Complex and the Wits Basin and implication of both surveys for mineral exploration. Ground penetration radar (GPR): basic principles of DPR; instrumentation; data acquisition; data processing and interpretation; practical example of GPR method: its application in diamond exploration; GPR application in characterization of construction site. Practical example of integrated geophysical method: kimberlite exploration (South Africa and Australia); precious metals and base metallic deposits (South Africa); characterization of water bearing formation (Karoo basin); characterization of construction site (South Africa).

MEG 4543 : Underground Mining [Credits 10]
Pre-requisite : *MEG 3144*
Module Content **:** Underground mining methods – selection criteria; unsupported methods; supported mining methods; caving mining methods; comparison of underground mining methods. Underground mining and material handling operations; drilling pattern in tunnelling and sequence of detonation (short-hole and long-hole blasting), underground commnunation at its benefits, haulage systems and equipment/infrastructure, design of ore/waste passes and their uses, skipping operations. Basic concepts of underground ventilation and air-conditioning. Underground mine planning and design: open pit versus underground; unique characteristics of a mine planning and design project, steps in the nine-planning process (baseline assessment, reserve determination, pre-mine planning and subsystem design.

MEG 4544 : Mine Safety and Health [Credits 10]
Pre-requisite : *MEG 3247*
Module Content **:** Concepts of health and safety – hazardous nature of the mining business; health and safety issues associated with mining; mine health and safety policies and legislations; enforcement of health and safety standards in mines; health and safety management system; key elements of successful health and safety management; case for and against integration of mine health and safety management system and other systems. Health-related illnesses and diseases in the mining industry (including those involving coal dust, silica dust, diesel particulate matter, asbestos, noise, lead, welding fumes, and skin disorders; protection of miners from occupational illnesses and diseases). Accident causation, prevention and control: basic theories of accident causation; accident cases; recognition and assessment of occupational hazards; accident prevention and control measures; accident investigation procedure and reporting. Measurement of safety performance: Statistical parameters; accident data collection and statistical analysis; safety performance reporting; safety performance of South Africa mining industry. Risk assessment and management: concept of risk assessment; types of risk assessment; principles and process of risk management; and hierarchy of risk control.

MEG 4545 : Engineering and Transport Systems for Miners [Credits 10]
Pre-requisite : *MEG 3243*
Module Content **:** Classification of material handling methods and equipment; principles of material handling; essentials of equipment selection; fundamentals of powering systems for machines (electrical, pneumatic, and hydraulic); surface and underground mine excavators. Haulage systems: development and trends, general applicability, and types of off-highway trucks; haulage road design considerations and construction; types, general applications, design and construction of belt conveyor systems; determination of load carrying capacity and power requirements; improved surface material haulage system; tracked and trackless transportation systems; performance and selection of locomotives to meet output requirements; traction and braking equations. Mine hoisting systems: basic hoisting systems and their special applications to different mine conditions; wire ropes and

their use in winding and haulage systems; rope construction, performance characteristics, sizing and selection; types, speed control, and braking devices of winders; hoisting calculations.

FOURTH YEAR MODULES – SEMESTER 2:

MEG 4546 : Non-Entry Mining [Credits 10]
Pre-requisite : MEG 3245
Module Content **:** Concepts and classification of non-entry mining; origin and types of novel and innovative mining techniques. Mine mechanization: developments in mine mechanization, drivers for mechanization, issues or barriers to technology implementation. Selection and introduction of mechanization to a mining operation. Rapid excavation machines: concept of rapid excavation; description and applications of continuous miners; tunnel boring machines; raise borer; shaft boring; and roadheaders. Remote-control and tele-operation applications in mining: status and description of tele-operation systems for mining; considerations for successful introduction of teleoperation into mining. Mining automation and robotics: attractive features, drawbacks, mining applications, and motivation for mining automation; major challenge in introducing automation technology to the mining industry; importance/benefits and characteristics of general and mining robots; application of robotics in mining; advantages of the use of robotics; and sources of robotic efficiency. Methane drainage and underground gasification.

MEG 4641 : Hydrogeology [Credits 10]
Pre-requisite : *MEG 3241*
Module Content : Physical hydrogeology – Darcy's law and hydraulic conductivity; hydraulic properties of fractured rocks; Karst aquifers; groundwater potential and hydraulic head; interpretation of hydraulic head and groundwater conditions. Groundwater flow theory and its applications: transmissivity and storativity of confined aquifers; release of water from confined aquifers; transmissivity and specific yield of unconfined aquifers; equations of groundwater flow; analytical solutions of one-dimensional groundwater flow problems; groundwater flow patterns; groundwater and geology; measurement and interpretation of groundwater level data. Groundwater resources and environmental management: surface water-ground water interaction; land subsidence; sea water intrusion; flood control; groundwater and geotechnical engineering. Groundwater flow to wells and hydraulic testing: field determination of hydraulic properties; steady-state flow to a well; methods of images - boundary effects; transient flow to a well - the Theis method (confined, unconfined, and semi-confined aquifers); Slug test; horizontal well hydraulics. Groundwater quality and contaminant hydrogeology: transport of contaminants in groundwater (non-reactive and reactive dissolved contaminants, non-aqueous phase liquids); source of groundwater contamination.

MEG 4642 : Advanced Mine Management and Environmental Management [Credits 10]
Pre-requisite : *MEG 3142*
Module Content : Mine Management – Forms of business organizations and organizational structure; design of organizational structure for mining enterprises. People and the profession: definition and methods of communication, media used, and importance and contents of a communication plan; teamwork and team development models; leadership styles; conflict management; negotiation; professionalism and ethics. Project management: characteristics of projects; project management processes; stakeholder management; project planning, key elements of successful project management; project management framework; project phases and project life cycles; organizational structure and culture; key general management and project management skills; CPM and PERT network construction and analysis; relationship between time-cost-quality/performance; use of current project management software in solving problems. Environmental Management: Laws and regulations of mine site environmental management; air and water quality management issues; acid mine drainage problems and management; characterisation and problems of mine waste, site selection, disposal methods, plan and design of waste containment systems, and waste management methods; mine reclamation planning, techniques, cost estimation, and management; site characterisation and rehabilitation of abandoned mines; mine closure and financial provision; computer applications of mine environmental management.

MEG 4644 : Small-Scale Mining [Credits 8]
Module Content : Overview of artisanal and small-scale mining (ASM) – history of mining in Africa; concept and general characteristics of ASM; importance and negative perceptions of ASM; relationship between small-scale and large-scale miners. Mining and mineral processing methods: categories of small-scale mining; small-scale mining techniques. Mineral processing techniques; alluvial and primary ore processing techniques and equipment; mercury amalgamation. Constraints and barriers of small-scale mining: permitting/statutory requirements, lack of access to finance, lack of technical skills, lack of market access, lack of access to technology, administration delays, and presence of active anti-small-scale mining tradition; technology transfer and future technology interventions in ASM. Safety, health and environmental issues: safety and health issues; environmental pollution community health issues; improving the occupational health and safety of mineworkers and their communities. Social and labour issues: nature, extent, and constraints of women participation in ASM; overcoming constraints and offsetting barriers to women participation in ASM; causes of child labour; children involvement in ASM; consequences of child labour; ways of stopping child labour; ways of assisting small-scale miners; role of various stakeholders.

MEG 4647 : Underground Surveying [Credits 10]
Prerequisite : *MEG 3244*
Module Content : Correlation surveys; underground extension of lines (grade and direction lines), surveys in steep and precipitous sights. Survey in vertical and inclined raises. Correlation surveys and methods. Mechanical correlation surveys: methods based on one wire in each of two vertical shafts and two or more wires in a single vertical shaft (exact alignment, approximate alignment, Weiss quadrilateral). Error analysis of Weisbach. Accuracy of correlation by wire methods. Gyroscopic Correlation: principle of the north seeking gyroscope, determining gyroscopic azimuth, applications of the gyroscope. Subsidence monitoring: classification of subsidence, effects of subsidence, subsidence over flat and inclined laying seams areas of extraction, importance of angle of draw in protection of surface properties, subsidence prediction, prevention and protection measures.

MEG 4990 : Research Project & Mini-Dissertation [Credits 30]
Module Content : The module is designed to develop the research skills of students through the completion of a research project on an approved topic in the context of any of the niche areas of the Department. 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 analyse data using appropriate tools, present the findings both orally and in the form of a research report; the report should include a statement of the research problem, literature review including recent journal resources, objectives and hypotheses, methodology, results and data analysis, and conclusion and recommendations.

6.3. BACHELOR OF ENVIRONMENTAL SCIENCE HONOURS DEGREE [ESHESH with HWR specialisation] OFFERED IN THE DEPARTMENT OF EARTH SCIENCES

6.3.1. BACHELOR OF ENVIRONMENTAL SCIENCE HONOURS DEGREE [HWR specialisation]: ADMISSIONS REQUIREMENTS

Qualification	Qualification code	Duration	Admission requirements
Bachelor of Environmental Sciences Honours (Hydrology and Water Resources)	ESHESH (HWR specialization)	1	(a) A candidate will be allowed to register for the Honours degree only if he/she possesses a 60% average pass in Bachelor of Environmental Sciences or equivalent subject to SENATE approval. (b) Prospective candidate could be subjected to a final selection test which serves to assess their preparedness for the Honours course.

6.3.2. BACHELOR OF ENVIRONMENTAL SCIENCE HONOURS DEGREE [HWR specialisation]: RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a)	The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture.
	(b)	The honours degree is offered over ONE academic year and students write examinations and present themselves for continuous assessment during the year of registration.
	(c)	**Project reports must be handed in before the 30th November of the academic year in order to graduate in the following May graduation.**
	(d)	Except with the special permission of SENATE, the duration of the full-time study will not exceed TWO years
	(e)	The degree will not be conferred on a candidate before at least one year has elapsed since he/she obtained the Bachelor's degree or another undergraduate degree as set out in the Faculty rules and unless he/she has been registered for one year at this University.
ASSESSMENT CRITERIA	(a)	Candidates will only be assessed in a specific module if they attended lectures, tutorials and prescribed practical satisfactorily and obtained a semester mark of at least 50%.
	(b)	A student must attain a minimum of 50% pass in **each** of the components of assessment. A student, who fails one of these components, will be allowed to repeat only that component. The written examination component will be conducted during the next normal examination period for that specific module.
	(c)	All written examinations will be taken only during official examination sessions**.**
	(d)	A candidate who fails two modules in the degree and obtains an aggregate of at least 50% may be admitted for assessment in those modules on one further sitting.
	(e)	To obtain the degree cum laude, a candidate must attain an aggregate of 75% or higher.
	(f)	To be awarded the BSc Hons degree, the candidate must accumulate at least 120 credits at this level.
	(g)	Special examinations will **not** be offered in the BSc Hons degree.
	(h)	An Aegrotat Examination may be granted to a student who has been prevented from sitting for the examination:

	• By illness on the day of the examination or assessment, or immediately before the examination or assessment, provided that a medical certificate from a registered medical practitioner is submitted to SENATE, and/or provided that the student's application is supported by the invigilator concerned or another responsible person; or • As a result of domestic circumstances such as serious illness or death of a close relative during the examination or assessment, or other reasons, provided that the SENATE judges it to be a bona fide case, and the student can provide satisfactory proof of such extraordinary circumstances.

BACHELOR OF ENVIRONMENTAL SCIENCE HONOURS DEGREE [code: ESHESH (HWR)]

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
HWR 5141: **Applied Hydrology [Credits 16]**	**HWR 5241:** **Water Resources Management [Credits 16]**
HWR 5142: **Applied Hydrogeology [Credits: 16]**	**HWR 5242:** **Applied Meteorology [Credits 16]**
HWR 5143: **Water Supply Systems [Credits: 16]**	**HWR 5243:** **Water Treatment Processes [Credits 16]**
COMPULSORY YEAR MODULES	
HWR 5990 [credits 32]: **Honours Research Project**	
Total Credits only = 120	

HWR 5141: Applied Hydrology [Credits 16]
Probability distributions, parameter estimation and probability plotting; probability as a hydrologic planning tool; probability of hydrologic events, including flood, runoff volume and precipitation; derivation of return period and regional flood frequency; hydrologic time series; time series analysis and synthesis, and their application; stochastic analysis of rainfall and streamflow; reservoir siting and yield analysis, practical problems in hydrologic practice, including floodplain mapping and flood regulation, and the design of urban storm drainage, highway culverts, spillways and cooling ponds.

HWR 5142: Applied Hydrogeology [Credits: 16]
Principles of groundwater flow; solutions to equations of flow in confined and unconfined aquifers; computation of drawdown due to well pumping in various aquifer settings; determination of aquifer parameters from time-drawdown data under steady-state and non-equilibrium flow conditions; effect of partial well penetration; regional groundwater flow systems under steady-state and transient conditions; computation of travel time for pollutants in groundwater; groundwater management; surface-groundwater interactions; groundwater modelling and types of published numerical simulation models; finite difference and finite element approaches; data requirements and the accuracy of models; application of groundwater models; general application of hydrogeology to human concerns.

HWR 5143: Water Supply Systems [Credits: 16]
Water uses and quantities; water characteristics, quality and treatment; bulk water supply systems, siting and zoning; water demand and design period; types of water transmission conduits; transmission design considerations and hydraulic design; water transmission by pumping; types of distribution systems; design considerations and distribution system design; pipe materials for transmission and distribution; leak detection and control; software packages for design and simulation.

HWR 5241: Water Resources Management [Credits 16]

Traditional institutional approach of fragmented water resources management; principles of integrated water resources management as a comprehensive approach to resource management; conjunctive use schemes; rainfall partitioning; catchment planning and management processes; water allocation; social, institutional, environmental and financial considerations; calculation of demand (rural, urban and environmental), demand management; water as an economic good and pricing of urban and peri-urban water; market conditions and failures, and public policy in resource management; competing uses of water; conflict resolution; private sector participation; conditions and challenges in managing the resource; key elements of integrated management emphasizing inter-generational and intra-generational equity (sustainability); privatization and user stakeholder participation in resource management; case studies, especially from the southern Africa region; transboundary issues (conventions, treaties and protocols).

HWR 5242: Applied Meteorology [Credits 16]
Principles of radar operation and radar remote sensing techniques; types of radar and their applications in meteorology; use of atmospheric data and cloud imagery from satellites for understanding the atmosphere and for weather forecasting.

HWR 5243: Water Treatment Processes [Credits 16]

Water storage and offtake structures; water aeration, chemical precipitation and ion exchange; storage, preparation and dosing of reagents; rapid and slow mixing; coagulation and flocculation; sedimentation; rapid and slow sand filtration; removal of dissolved organic and inorganic solids through ion exchange, membrane technologies, adsorption and chemical oxidation; water

stabilization; treatment, disposal and reuse of backwash water and sludge; operation and management of water treatment plants; community-level water purification on a domestic scale; disinfection and decontamination of aquifer.

HWR 5990 [credits 32]: Honours Research Project

Students would be expected to carry out a research project on a topic of their choice within the Hydrology and Water Resources field. A qualified member of Staff will offer guidance in the carrying out of the research.

6.4. MASTERS OF EARTH SCIENCE (ESMMES) QUALIFICATIONS OFFERED IN THE DEPARTMENT OF EARTH SCIENCES IS ONLY BY RESEARCH

6.4.1 ADMISSION REQUIREMENTS

Qualification	Qualification code	Duration	Admission requirements
Master of Earth Science	ESMMES	2 years	(a) A 4 years BSc or BSc Honours in Geology, hydrology and Water Resources, Mining and EarthSciences/Geosciences with an average of 65%, an upper-second class for a class-based systems with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE. (b) An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. (c) Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

6.4.2 RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title or topic of the proposed dissertation, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee, the Faculty Higher Degrees Committee, the University Higher Degrees Committee and final approval by SENATE. (b) The Research proposal must be approved by the Faculty Higher Degrees Committee. (c) Unless otherwise decided by SENATE and subject to special provisions in the school: • The Master's degree may be conferred only after the candidate has been registered for a period of at least TWO years fulltime. • Extension may be granted only in exceptional cases and for only ONE year. • A student who desires an extension must submit a motivated application for consideration by SENATE. (d) The Research MSc degree is conferred based on a dissertation and an examination, or a dissertation only, as determined by the Faculty Academic Board. (e) The taught MSc degree is conferred based on a mini dissertation and a component of taught modules which must all be passed as per degree requirements (f) The Head of Department may prescribe certain ancillary modules which must be enrolled or passed before the date of the Master's examination. (g) The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture. (h) SENATE may, at any time, suspend or cancel the registration of any student who, in its view, is not making satisfactory progress. (i) Students who wish to defer their studies at **any stage MUST APPLY** to the relevant department. If granted, such deferment will be for **a maximum period of one year**, after which a further application must be submitted. Deferment will, **at most**, be granted twice. (j) Unless otherwise decided by SENATE and subject to special provision in the school rules, the degree may be conferred if the candidate has been registered for a minimum of one academic year. (k) Before registration for 2nd or further years, the student must write a full progress report for the year passed which is signed by the supervisor and the HOD to show progress, which will be approved /not approved by the Executive Dean. This progress report will count as the last quarterly report of the passed year for the student. **No** student will be allowed to register without the approval of the Executive Dean
ASSESSMENT CRITERIA	(c) Procedures as per post-graduate policies and guidelines will be followed – this includes the agreement between the student and supervisor that must be in placed as well as the quarterly reports that must be send to the Faculty Research office as proof of student's progress

6.5. DOCTORAL (PhD) QUALIFICATIONS OFFERED BY THE DEPARTMENT OF EARTH SCIENCES IS BY RESEARCH ONLY

6.5.1. ADMISSION REQUIREMENTS

Qualification	Qualification Code	Duration	Admission Requirements
PhD Geology	ESPDGP	3 years	(a) A MSc in Geology, Mining and Earth Sciences/Geosciences with a minimum mark of 65% OR equivalent status conferred by SENATE. (b) An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. (c) Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.
PhD Mining	ESPDPM	3 years	(a) A MSc in Geology, Mining and Earth Sciences/Geosciences with a minimum mark of 65% OR equivalent status conferred by SENATE. (b) An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. (c) Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.
PhD Mining and Environmental Geology	ESPMEG	3 years	(a) A MSc in Geology, Mining and Earth Sciences/Geosciences with a minimum mark of 65% OR equivalent status conferred by SENATE. (b) An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. (c) Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.
PhD Hydrology and Water Resources	ESPHWR	3 years	(a) A MSc in Hydrology and Water Resources with a minimum mark of 65% OR equivalent status conferred by SENATE. (b) An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. (c) Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

6.5.2 RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee, the Faculty Higher Degrees Committee, the University Higher Degrees Committee and approval by SENATE. (b) PhD students should defend their proposals within one year of first registration. (c) If a student fails to defend the proposal within the specified minimum period, the student will be notified in writing of 6 months extension for PhD proposal defense. (d) In circumstances where the student fails to comply after the extension, the Faculty Higher Degrees committee will write a recommendation to the University Higher Degrees committee to consider recommending the student to the Registrar for deregistration. (e) The student will be allowed to appeal to Higher Degrees Committee within 2 months of deregistration. (f) The Research proposal must be approved by the faculty's Higher Degrees Committee. (g) Unless otherwise decided by SENATE and subject to special provisions in the Faculty: (h) The degree may be conferred only after the candidate has been registered for a period of at least THREE years fulltime. (i) Extension may be granted only in exceptional cases and for only ONE year. (j) A student who desires an extension must submit a motivated application for consideration by SENATE.
ASSESSMENT CRITERIA	(a) Procedures as per Postgraduate policy guidelines will be followed. This will include the agreement between the supervisor and the doctoral student and the quarterly progress reports that must be submitted in time to the Faculty Research office (b) External examination of thesis will be done as per Post Graduate policies (c) Viva Voce as per school postgraduate guidelines through the office of the Executive Dean. If a student fails the Viva Voce, the degree will not be awarded.

SECTION 7:

DEPARTMENT: GEOGRAPHY AND ENVIRONMENTAL SCIENCES

7.1. QUALIFICATIONS OFFERED BY THE DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL SCIENCES

BSc degrees (BSc):

- Bachelor of Environmental Sciences CODE: ESBNVSC
- Bachelor of Environmental Sciences (Disaster Risk Reduction) CODE: ESBDRR
- Bachelor of Environmental and Natural Resource Science (NOT OFFERDED IN 2021) CODE: ESBNR

BSc Hons degrees (BSc.Hons)

- Bachelor of Environmental Sciences Honours (Ecology & Resource Management) CODE: ESHESH (ERM)
- Bachelor of Environmental Sciences Honours (Geography) CODE: ESHESH (GEO)

MSc degrees (MSc):

- Master of Environmental Sciences (Ecology and Resource Management) CODE: ESMERM
- Master of Environmental Science (Geography) CODE: ESMESG

PhD degrees (PhD):

- Doctor of Philosophy (Geography) CODE: ESPDPG
- Doctor of Philosophy (Environmental Sciences) CODE: ESPPES

7.2. BACHELOR OF SCIENCE QUALIFICATIONS OFFERED BY THE DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL SCIENCES [CREDITS = 360]

7.2.1. ADMISSIONS REQUIREMENTS

(a) *Requirements for Bachelor of Environmental Science degree:* Specific requirements for Bachelor of Environmental Science degree: 40% pass for Mathematics, English and Physical Science and 50% for either Life Science, Geography or Agriculture.

(b) *Bachelor of Environmental Sciences (Disaster Risk Reduction degree):* Matric pass at C=60% (HG)/(NSC) or 70% (SG) pass in Geography; 60% (HG)/(NSC) pass in either Mathematics and/or Life Sciences and an adequate achievement in Physical Sciences and Economics.

7.2.2. RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

(a) Students with outstanding modules from previous level of study will only be registered for a maximum of 1 FTE in the next level of study.

Bachelor of Environmental Sciences (BENVSC)

Year	Rule
1	60% pass of all modules registered in order to proceed to second year level.
2	60% pass of all modules registered to proceed to third year level.

Bachelor of Environmental Sciences in Disaster Risk Reduction (ESBDRR)

Year	Rule
1	60% pass of all modules registered in order to proceed to second year level.
2	60% pass of all modules registered in order to proceed to third year level.
3	Passed all modules in previous years unless exempted by the Dean.
4	Passed all modules in previous years unless exempted by the Dean.

Student Progression for Geography Major to Bachelor of Environmental Science Degree

(a) FIRST YEAR MODULES: A student should pass at least two compulsory first-year modules to register for any second-year modules
(b) SECOND YEAR MODULES: A student should pass all compulsory second year modules to register for any third-year module.
(c) THIRD YEAR MODULES: A total of four modules should be taken at this level. Students should select at least one module from Group A and another from Group B. The two other modules can be selected from any three of the groups

GROUP A	GROUP B	GROUP C
GEO 3142: Geomorphology GEO 3143: Biogeography GEO 3242: Climatology	GEO 3144: Population and Demography GEO 3145: Settlement and Industrial development GEO 3243: Geography of Tourism GEO 3244; Rural Geography & Development	GEO 3141: Geography of South Africa GEO 3241; Remote sensing & Geographic Information Systems

7.2.3. ASSESSMENT FOR BSc DEGREE:

- Continuous Assessment will consist of tests, practical, tutorials, projects, assignments and reports.
- Students will write examinations at the end of each semester on condition that they qualify to do so.
- The minimum final pass mark in any module is 50%.
- To obtain the degree *cum laude*, a candidate must attain an aggregate of 75% or higher.

7.2.4. THE BSc DEGREE QUALIFICATIONS OFFERED IN THE DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL SCIENCES:

Bachelor of Environmental Sciences **[CODE: ESBBES]**

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7	
Core Modules					
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**
ERM 1141 (12) The Natural Environment as System **ECS 1141** (10) English Com Skills **GEO 1120** (10) Intro. to cartography, map analysis and aerial photograph interpretation **GEO 1141** (10) Integrated study of major World Environments 1	**ERM 1241** (12) Ecological Principles for Environmental Management **ECS 1246** (10) English Com Skills **GEO 1220** (10) Elements of Remote Sensing and Geomatics **GEO 1241** (10) Integrated study of major World Environments 2	**ERM 2141** (12) Principles of Resource Management **GEO 2141** (10) Spatial Organization of Society **GEO2142** (10) Quantitative and Qualitative	**ERM 2241** (12) Pollution & Environmental Quality **GEO 2241** (10) Patterns and processes in Physical Geography **GEO 2242** (10) Themes on the Geography of Africa	**ERM 3141** (13) Resource Evaluation & Info. Systems **ERM3142** (15) Climate Change	**ERM 3241** (13) Environmental Impact Assessment **ERM3242** (15) Environmental Economics and Green Economy
GROUP A MODULES: Select any 2 of the following:		***2 modules selected at first year level***		***Select 2 of the following modules***	
BIO 1141 (16) Diversity of Life **CHE 1145** (16) General Chemistry for the Applied Sciences **MAT 1143** (10) Mathematics for Biological, Earth and Life Sciences **STA 1149** (8) Basic statistics **ECO1141** (12) Basic Microeconomics	**BIO 1143** (16) Ecology, adaptation & evolution **CHE 1123** (8) Inorganic Chemistry for the Applied Sciences & **CHE 1224** (8) Organic Chemistry for the Applied Sciences **MAT 1243** (10) Mathematics for Biological, Earth and Life Sciences **STA 1249** (8) Basic statistical inference **ECO1241** (12) Basic Macroeconomics	**BIO 2142** (20) Ecology **CHE 2121** (10) Inorganic Chemistry **CHE 2122** (10) Organic Chemistry **ECO2141** (15) Intermediate Microeconomics	**BIO 2246** (20) Conservation Biology I **CHE 2220** (10) Analytical Chemistry **ECO 2241** (15) Intermediate Macroeconomics	**GEO 3141** (16) Geography of South Africa **GEO 3142** (16) Geomorphology **GEO 3143** (16) Biogeography **GEO 3144** (16) Population and Demography	**GEO 3241** (16) Remote Sensing and Geographic Information Systems A **GEO 3242** (16) Climatology **GEO 3243** (16) Geography of Tourism **GEO 32644** (16) Rural Geography and Development
GROUP B MODULES: Select any of these to increase credits up to 120		**Any 1 of the following selected from year 1**			
MEG 1141 (10) Intro. to Geology **URP 1141** (8) Intr. to Society and Planning **HWR 1141** (10) Intro. Hydrology & Meteorology **PAD1141** (12) Intro. to Public Administration I: Concept and Context	**MEG 1241** (10) Intro. to Hydrogeology & Soil Science **URP 1241** (8) Principles & Techniques of Planning **HWR 1241** (10) S. A. Weather & Water Resources **PAD1241** (12) Intro. Public Administration II: The South African Context	**MEG 2141** (12) Sedimentology, Stratigraphy & Basin Analysis **URP 2143** (12) Intro. to Urban Planning **HWR 2141** (12) Rural Water Supply & Sanitation **PAD2141** (15) Policy-making, Organizing and Financing **PEL2141** (12) Planning & Environmental Law 1	**MEG 2241** (10) Intro. to Photogeology & Remote Sensing **URP 2243** (12) Quantitative methods in planning **HWR 2241** (12) Water Law & Institutions **PAD2241** (15) Staffing, Determining Work Procedures and Control **PEL2241** (12) Planning & Environmental Law 2		
TOTAL 12 (13 for those who choose chemistry)		**TOTAL 10 MODULES**		**TOTAL 8 MODULES**	

Bachelor of Environmental Science (Disaster Risk Reduction) **[CODE: ESBDRR]**

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7		Year 4 - NQF level 8	
Core Modules							
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**
ECS 1141 (10) English Communication Skills (C) **DRR 1141** (8) Introduction to hazards and disaster (C) **PHY 1127** (8) Physics for Environmental & Agric Sciences 1 **BIO 1141** (8) Diversity of Life **CHE 1145** (10) General Chemistry for applied sciences **MAT 1143** (8) Mathematics for Biological, Earth and Life Sciences I (C) **ERM 1141** (10) The Natural Environment as a System (C) **GEO 1141** (10) Integrated Study of Major Worlds Environments 1 (C) **GEO1120** (10) Introduction to cartography and remote sensing (C) **(Choose one additional module from PHY, CHE or BIO)**	**ECS 1246** (10) English communication skills for environmental and health sciences (C) **DRR 1241** (8) Introduction Disasters and Risk Reduction (C) **PHY 1227** (10) Physics for Environmental & Agric. Sciences II **BIO 1243** (10) Ecology, adaptation and evolution **CHE 1224** (8) Organic Chemistry for applied sciences **MAT 1243** (8) Mathematics for Biological, Earth and Life Sciences II (C) **ERM 1241** (10) Ecological principles for Environmental Sustainability (C) **GEO 1241** (10) Integrated Study of Major world environments 2 (C)	**ERM 2141** (12) Principles of sustainable resource use **DRR 2141** (12) Natural hazards and disaster risk **DRR 2142** (12) Indigenous knowledge, hazards and disaster vulnerability **DRR 2143** (12) Water and sanitation in Disasters **GEO 2141** (12) Spatial organisation of Society (**All modules are compulsory**)	**ERM 2241** (12) Pollution and environmental quality **DRR 2241** (12) Anthropogenic and Technological hazards **DRR 2642** (12) GIS and Remote Sensing **DRR 2643** (12) Fire hazards and Disasters **GEO 2241** (12) Patterns and Processes in Physical Geography (**All modules are compulsory**)	**ERM 3141**(12) Resource evaluation and information systems (C) **DRR 3141** (12) Principles of disaster Risk Reduction (C) **DRR 3142** (12) Research methods (C) **DRR 3143** (12) Disaster Risk Reduction Policy frameworks (C) **DRR 3144** (12) Gender and disaster risk reduction **GEO 3144** (12) Population and demography (**Choose one additional module either from DRR 3144 or GEO 3144**)	**ERM 3241** (12) Environmental impact assessment (C) **DRR 3241** (12) Early warning systems (C) **DRR 3242** (12) Disaster Risk assessment and analysis (C) **DRR 3243** (12) Geographical Information systems for disaster risk Reduction (C) **DRR 3244** (12) Disaster planning and risk reduction (C) (**All modules are compulsory**)	**DRR 4150** (30) Experiential Learning (6 months) **DRR 4740** (30) Research and dissertation (year-long module)	**DRR 4241** (15) Land degradation and rehabilitation **DRR 4242** (15) Disaster Preparedness and response **DRR 4243** (15) Post Disaster rehabilitation and reconstruction **DRR 4244** (15) Economics and Financial Aspects for disaster risk reduction
Total: 13 modules **Total credits: 120**		**Total: 10 modules** **Total credits: 120**		**Total: 10 modules** **Total credits: 120**		**Total: 06 modules** **Total credits: 120**	

Note: Compulsory modules in the first year are indicated by (C)

7.2.5. DESCRIPTION OF UNDERGRADUATE MODULES OFFERED BY THE DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL SCIENCES

7.2.5.1 ERM MODULES CONTRIBUTING TO BACHELOR OF ENVIRONMENTAL SCIENCES

FIRST YEAR MODULES

ERM 1141 : The Natural Environment as a System [Credits 12]
The content of this module introduces the students to environmental science. Through the module, awareness of the social, economic and political dimensions of environmental science will be raised. Students will also be taught to critically evaluate the state of the South African environment.

ERM 1241 : Ecological Principle for Environmental Management [Credits 12]
In this module, several basic ecological principles are outlined, using practical approaches that are widely applicable.

SECOND YEAR MODULES

ERM 2141 : Principles of Resource Management [Credits 12]
Prerequisite : ERM 1141
This module outlines the discipline of resource management, covering the rationale for resource management; the foundation of resource management; controls on resource development; concepts and approaches to resource management and integrated resource management. The principles are applied by designing resource management strategies for specific environments, such as drainage basins, mountain ecosystems, arid and semi-arid environments etc.

ERM 2241 : Pollution and Environmental Quality [Credits 12]
Prerequisite : ERM 1241
This module covers the following: definition of pollution; development and scope of pollution science; effect of foreign bodies and substance in living things; source, pathways and sinks of main air and water pollution ; atmospheric conditions that influence transport, dispersal and reactions of air pollutants; the geopolitics of pollution; externalities and economic of pollution; introduction of environmental standards and environmental quality analysis; measure of environmental quality; issues and techniques for determining environmental quality standards; *global versus* national or regional environmental standards; introductory water quality analysis; air quality analysis; environmental health.

THIRD YEAR MODULES

ERM 3141 : Resource Evaluation and Information Systems [Credits 13]
Prerequisite : ERM 2141
This module covers the following: overview of techniques of resource evaluation; land system mapping; ecological surveys; soil surveys; land capability classification; land suitability evaluation; spatial data analysis; manual and computer-based generation of resource maps; environmental impact assessment; remote sensing; land information systems; development project evaluation; mini-project.

ERM 3142 : Climate Change [Credits 15]
Prerequisite : GEO 2241
This module covers: introduction to climate change; the physics of climate change (Milankovitch cycles, atmospheric and oceanic circulation, greenhouse effect, convections, etc); paleoclimate and climate model scenarios; biodiversity and vulnerability; ecosystem-based adaptation; ecosystem services; oceans and sea levels (mangrove forests, coral reefs); potential SA vegetation biome shifts and extinctions.

ERM 3241 : Environmental Impact Assessment and Modelling [Credits 13]
Prerequisite : ERM 2241
This module covers: origins of EIA; characteristics of environmental impacts; projects screening; scoping; baseline studies; impact prediction assessment methods; impact mitigation; impact monitoring and auditing; preparation of environmental impact statement; EIAs for the atmosphere; EIAs for land resources; EIAs for water resources; EIAs in South Africa; environmental risk assessments; environmental modelling.

ERM 3242 : Environmental Economics and the Green Economy [Credits 15]
This module covers: the competitive free market, the market equilibrium, market failures, externalities, property rights, benefit/cost analysis, valuation of ecosystems, recycling, common pool resources, tragedy of the commons and economics of fisheries.

7.2.5.2. GEOGRAPHY MODULES CONTRIBUTING TO BACHELOR OF ENVIRONMENTAL SCIENCES/DISASTER RISK REDUCTION

FIRST YEAR MODULES

GEO 1120: Introduction to Cartography, map analysis and aerial photographic interpretation [Credits: 16]
The module combines science, aesthetics, and technique that build on the premise that reality can be modeled in ways that communicate spatial information effectively. At the end of the module, students are able to acquire an understanding of different maps and remotely sensed images; interpret maps and aerial photographs; analyses key environmental and socio-economic issues using maps and aerial photographs; integrate map and aerial photograph data and use it for learning processes and projects; and reproduce maps at different scales.

GEO 1141 : Integrated Study of Major World Environments 1 [Credits 16]
The module introduces students to the atmosphere: atmospheric processes, weather and geographic patterns of climate; the biosphere: soil and vegetation processes and resulting geographic patterns; the hydrosphere: water in all its phases, movement and geographic distribution; the lithosphere: the formation, modification and geographic distribution of various landforms.

GEO 1220 : Elements of Remote Sensing & Geomatics [Credits 16]
The module covers the introduction to remote sensing (the composition of the atmosphere and electromagnetic energy, remote sensing techniques); introduction to GIS (advantages and functions); and geomatics and surveying. At the end of the module, students are able to acquire an understanding of different remotely sensed images (aerial photographs, satellite images); interpret maps and remotely sensed images; analyse key environmental and socio-economic issues using remotely sensed images; and integrate map and aerial photograph data and use it for learning processes and projects.

GEO 1241 : Integrated Study of Major Worlds Environments 2 [Credits 16]
Growing pressures on the natural environment through intensification of human land use may compromise ecosystem functions that are central to both the human and the natural world. This module introduces students to human environment relationship. It focuses on the relationship between people, development, space and the natural environment. The module also examines key themes such as population, urban studies, migration and their theoretical and empirical importance within geography. The module content will examine how humans across the world are part of, and create, unique locations that have issues such as resource depletion. This module focuses on human induced factors responsible for environmental deterioration, theories linking human beings and the environment to solve environmental problems.

SECOND YEAR MODULES

GEO 2141 : Spatial Organisation of Society [Credits 16]
Prerequisite : *GEO 1241*
Geography is presented as a socio-spatial science. Concepts and methodologies in the study of the spatial organisation of society are presented emphasising location, distribution, spatial patterns of the human environment, relations and interactions, the concept of the region and the new global perspectives, the dimension of space of space, including (cost, distance, time-time, social-distance); spatial process as it relates to diffusion and interaction, spatial pattern in relation to lines, points and areas.

GEO 2142 : Quantitative and Qualitative Research Methods [Credits 16]
Prerequisite : *GEO 1120*
This module aims to provide students with introduction to the range of qualitative and quantitative research methods that are applicable in geography. The module addresses various types of qualitative and quantitative research terminology such as research design, population, sampling etc. The module provides students with the knowledge of the different research methodologies and research process.

GEO 2241 : Patterns and Processes in Physical Geography [Credits 16]

Prerequisite : *GEO 1141*

This module covers a study of the patterns and processes of the physical environment focusing on biogeography, climatology, and geomorphology. Topics that are covered include the Biosphere, Hydrosphere and the Lithosphere. These include the world global circulations, earth-atmosphere interactions, adiabatic processes and forms of precipitation, global weather patterns, denudation processes and landforms, tectonic processes and landforms, biodiversity and global distribution patterns, major world vegetation types, ecosystem processes and biological invasions.

GEO 2242 : Themes on the Geography of Africa [Credits 16]

The course covers Regional Geography of Africa; contemporary map of Africa; physical environment as a resource; land degradation and desertification; tourism development and resource conservation; agricultural development; industrialization in Africa; population dynamics; urbanization; transport & settlement patterns; trade and trading organizations and change and challenges in Africa.

THIRD YEAR MODULES

GEO 3141 : Geography of South Africa [Credits 16]

Prerequisite : *GEO 2242*

Students will understand various issues or events taking place in South Africa particularly with themes in physical and human geography. The module focuses on the geography of South Africa, including issues dealing with the environment, history, society, and the economy.

GEO 3142 : Geomorphology [Credits 16]

Prerequisite : *GEO 2241*

The nature, purpose and scope of geomorphology; Structure and materials of the earth; Global tectonics; Tectonic and volcanic landforms; Weathering and mass-wasting processes; fluvial processes and landforms; Climate and denudation; Geological structures and landforms; Glacial landforms; Wave action and coastal geomorphology; Arid, Semi-arid and Desert landscapes; Karst processes, sinkholes and landforms. Course-based field trips will be conducted.

GEO 3143 : Biogeography [Credits 16]

Prerequisite : *GEO 2241*

Module covers current theoretical approaches, biological productivity and nutrient cycling, biotic interactions, natural and managed ecosystems, natural and anthropogenic disturbances, vegetation description, animal studies, quantitative and qualitative approaches to vegetation and animal studies. The module further provides a comparative analysis of natural populations and communities in terms of geographic variation, distribution density and disturbances, community stability, natural disturbances, human modifications of ecosystems and their possible consequences and resolutions

GEO 3144 : Population & Demography [Credits 16]

Prerequisite : *GEO 2141*

The module covers the nature and differences between population geography and demography and Variables in the study of population. At the end of this module, students are able to differentiate between population and demography; identify variables studied in population and demography; use theories to explain fertility, mortality and migration patterns; identify population issues that are of global concern; and use statistical techniques to measure population patterns and processes.

GEO 3145 : Settlement Geography & Industrial Development [Credits 16]

Prerequisite : GEO 2141

The module covers the patterns of rural African settlements-indigenous, colonial, post-colonial and these are examined at the micro-, meso- and macro scale. The basic historical model of urban evolution is related to the African context focusing on the interplay between indigenous' pre-industrial, colonial, and industrial cities. The rank-size and central place theory introduce the students to theories of size and spacing of urban centres. The spatial organisation of the city and urban problems are also studied as centres of industrial growth. Industrial location theory and regional development forms a major component of the last part of this module.

GEO 3241 : Remote Sensing & Geographical Information System [Credits 16]

Prerequisite : *GEO 1220*

The module covers knowledge and skills to be able to interpret and read information on satellite images and can integrate GIS data for decision support. Students are introduced to the concept of electromagnetic energy and remote sensing (definitions, waves and photons, sources of EM energy, electromagnetic spectrum, active and

passive remote sensing); energy interactions in the atmosphere and earth surface; Platforms; image data characteristics; multispectral scanners; Earth observation systems; radiometric and geometric corrections; image enhancements; digital image interpretation. The syllabus also includes GIS overview; geographic/spatial data; attribute data management; data input and editing; data analysis; spatial data modelling; map design and decision-making support.

GEO 3242 : Climatology [Credits 16]

Prerequisite : *GEO 2241*

This course serves as an introduction to the climate system of the Southern Hemisphere with particular focus on southern Africa. The course is aimed at developing a thorough understanding of the African climate system: its seasonality, intra-seasonal and inter-annual dynamics, and responses to tropical Atlantic and Indian Ocean influences. The emphasis is on the tropical atmosphere and oceans. The planetary-scale circulation of the atmosphere and oceans are discussed as backgrounds and subsequent topics with focus on the African climate. A climatology of tropical, subtropical and mid-latitude weather systems is discussed with focus on the structure, distribution, seasonal characteristics, and their role in the regional climates and inter-annual climate variability. The associated environment and societal consequences are also covered in detail.

GEO 3243 : Geography of Tourism [Credits 16]

Prerequisite : *GEO 2141*

The module deals with the study and analysis of tourism dynamics at the national, regional and international level. Topics covered include: the concept of tourism, tourism resources, geographical expansion of tourism, the nature of international tourism, the relationship between tourism and development and the impact of the industry to the economy, environment and society. The module further looks at ecotourism covering topics such as ecosystem dynamics and change, tourism principles, practices and philosophies, ecotourism resources in relation to carrying capacities and the role of the protected area, ecotourism and government policy and institutional arrangements for management.

GEO 3244 : Rural Geography & Development [Credits: 16]

Prerequisite : *GEO 2141*

The module examines the main influences on changes in the geography of rural livelihood. In this module, rural development is about progress and change in the rural areas of developing countries. It is concerned with the factors that affect rural change, how we define progress, and what can be done to bring about the intervening objective of rural development, which is to reduce rural poverty. The module also scrutinizes the concepts of rurality and rural development and considers a variety of approaches that have been anticipated in South Africa and elsewhere for the maintenance of rural communities and the protection of the rural landscape.

7.2.5.3. MAJOR MODULES CONTRIBUTING TO BACHELOR OF ENVIRONMENTAL SCIENCE IN DISASTER RISK REDUCTION (ESBDRR)

FIRST YEAR MODULES

DRR 1141 : Introduction to hazards and disasters [Credits 8]

To introduce learners to definitions and concepts to perform hazard identification and assessment. Explore and understand hazards, risks and disasters in the society and to be able to prevent it and reduce the impact on people's lives. To develop the capability for hazard assessment.

DRR 1241 : Introduction Disasters and Risk Reduction [Credits 8]

To introduce learners to key concepts and classification of causal factors of disasters and illustrate how Environmental Science knowledge may contribute to disaster risk reduction. Research skills and tools and methodologies disasters and Risk Reduction. Communication skills. Research skills and time management skills; Ethical skills in disaster situations, Teamwork skills.

SECOND YEAR MODULES

DRR 2141 : Natural hazards and disaster risk [Credits 12]

Prerequisite : *DRR 1141*

To understand the different types of natural hazards and nature of vulnerability including extra-terrestrial hazards such as Extra-Terrestrial Impactors and Solar Flares, Geophysical Hazards such as Earthquakes, Tsunami, Landslides, and Volcanoes, Meteorological events such as Windstorms, Tornadoes, Flood, and Drought. To compare and contrast the different severity imposed by such natural, with specific reference to their frequency, geographical extent, economic vulnerability, human vulnerability, our ability to forecast or predict them and the scientific limits on these.

DRR 2142 : Indigenous knowledge, hazards and disaster vulnerability [Credits 12]
Prerequisite : *DRR 1241*
To introduce indigenous knowledge, values and perceptions towards hazards and disaster vulnerability. Apprecite the role of local knowledge. Wrting skills; To understand, acknowledge and respect indigenous knowledge as a valuable source of information and as a key contributor to reducing risk in many parts of the world.

DRR2143 : Water and sanitation in Disasters [Credits 12]
Prerequisite : *DRR 1241*
To introduce learners to Water and Sanitation issues during and after disasters and equip them with knowledge and skills of dealing with water provision, sanitation, and solid waste management during disasters.

DRR 2141 : Anthropogenic and Technological hazards [Credits 12]
Prerequisite : *DRR 1141*
To introduce learners to different types of human and technological hazards and the dynamics that bring them about. Introduce learners to the concept of vulnerability to disasters. Knowledge on difference natural hazards; Acquire knowledge on vulnerability assessment; Critical thinking and model building; Practical skills in identifying hazards; Teamwork; Report writing and communication skills.

DRR 2242 : GIS and Remote Sensing [Credits 12]
Prerequisite : *DRR 1241*
This module will introduce the theory and practice of GIS and remote sensing as well as an introduction to a range of methods for collection, management and interpretation of spatial data. Operational skills necessary for data entry, data manipulation and analysis, and the production of interpretable output. Skills to acquire appropriate remote sensing data and extract geo-information from such data; Gain Geo-technical knowledge; Critical thinking and evaluation; Develop spatial, visualisation and analytical skills.

DRR 2243 : Fire hazards and Disasters [Credits: 12]
Prerequisite : *DRR 1141*
To understand the common fire hazards and how to mitigate it in the society. To provide students with an in-depth understanding of the processes that are responsible for fire hazards, together with the skills required to help communities prepare for and respond to fire disasters. Understand the National Veld and Forest Fire Act which provides a comprehensive system for veldfire management in South Africa.

THIRD YEAR MODULES

DRR 3141 : Principles of disaster Risk Reduction [Credits 12]
Prerequisite : *DRR 2141*
To provide a sound and sustainable development that incorporates risk management in areas prone to disasters. To develop knowledge and a critical outlook on the different frameworks, approaches and methods for disaster prevention, preparedness and vulnerability reduction. Provide students with a basic understanding on the interphase of disaster response, relief and recovery to disaster risk reduction.

DRR 3142 : Research methods [Credits 12]
Prerequisite : *DRR 2142*
To introduce learners to development of research work in disaster risk studies. Explore and understand the fundamental knowledge on research methodologies and theories. To develop the academic writing skills needed to in the writing of the dissertation.

DRR 3143 : Disaster Risk Reduction Policy frameworks [Credits 12]
Prerequisite : *DRR 2143*
To analyse international and national policies informing disaster risk reduction. Policy review and analysis for disaster risk reduction. To make a critical analysis on the implementation and intended outcomes of such policy. Critical thinking. Teamwork. Communication skills.

DRR 3144 : Gender and disaster risk reduction [Credits 12]
Prerequisite : *DRR 2141*
To integrate gender perspective in disaster risk management to ensure that both women and men have the necessary capacities in addressing their respective vulnerabilities to enable them to protect themselves, their families and their immediate communities.

DRR 3241 : Early warning systems [Credits 12]
Prerequisite : *DRR 2241*
Explore and understand hazard relationships and their interdependence. Link hazards with everyday real-life situations.

DRR 3242 : Disaster Risk assessment and analysis [Credits 12]
Prerequisite : *DRR 2243*
To introduce learners to assess risk as a foundation for risk reduction and preparedness planning and can analyse risks based on different types of methods for risk analysis. Can critically analyse and draw conclusions from completed risk analyses. Understand how risk perception influences the evaluation of risks.

DRR 3243 : Geographical Information systems for disaster risk Reduction [Credits 12]
Prerequisite : *DRR 2242*
To provide an overview of the use of spatial information in Disaster Risk reduction. Analysis of data and outputs of GIS processed application in the disaster management and disaster risk reduction. Spatial decision making in disasters. Technical skills. Teamwork. Communication skills. Project management; Mapping skills; Advanced computer skills.

DRR 3244 : Disaster planning and risk reduction [Credits 12]
Prerequisite : *DRR 2242*
To introduce learners to different kinds of hazards and their classifications. Explore and understand planning in disaster risk reduction. To be able to integrate disaster risk planning to other developmental planning.

FOURTH YEAR MODULES

DRR 4150 : Experiential Learning (6 months) [Credits 30]
To equip learners with the broader national and international practical experience in disaster risk reduction and management. To integrate learnt disaster risk theoretical concepts into practice; To explore the broader national and international environment of disaster risk reduction; Critical thinking; Decision making; Policy evaluation; Team building skills; Communication skills; Analytical skills.

DRR 4241 : Land degradation and rehabilitation [Credits 15]
Prerequisite : *DRR 3243*
To provide students with knowledge and understanding of the causes of land degradation. To inculcate an understanding of strategies to rehabilitate degraded environments. Good communication skills and knowing who to report to during a disaster or public health emergency. Technical abilities to use the available equipment and resources and be aware of security matters; Decision making; Organisational skills; Teamwork.

DRR 4242 : Disaster Preparedness and response [Credits 15]
Prerequisite : *DRR 3144*
To analyse the nature of key recurrent threats in Limpopo province; Develop skills in Integrated planning and early warning systems for Limpopo province. Develop skills for emergency preparedness and community response. Good communication skills and knowing who to report to during a disaster or public health emergency; Technical abilities to use the available equipment and resources and be aware of security matters. Decision making and Organisational skills.

DRR 4243 : Post Disaster rehabilitation and reconstruction [Credits 15]
Prerequisite : *DRR 3144*
To acquire knowledge on post-disaster rehabilitation and recovery, encompassing support strategies that are geared towards the restoration of human-centred services and infrastructure, as well as the restoration of the physical and ecological integrity of the affected ecosystems. Analytical skills; Critical thinking; Teamwork, Technical skills; Human empathy and ethics; Political awareness and Assessment methodologies.

DRR 4244 : Economics and Financial Aspects for disaster risk reduction [Credits 15]
Prerequisite : *DRR 3142*
To equip learners with the concepts of disaster risk financing and responses. Explore and conceptualise disaster risks financing and responses; To harness capabilities of identifying disaster risks and conceptualise financial aspects of recovery and reconstruction; Evaluation of economic impacts of disasters.

DRR 4340 : Research and dissertation (year-long module) [Credits 30]
Explore and understand the fundamental knowledge of disaster theories; To engage on wider critical thinking on disaster management writing and discourse.

7.3 BACHELOR OF SCIENCE HONOURS DEGREE [BSc. Hons] OFFERED IN THE DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL SCIENCES

7.3.1. ADMISSIONS REQUIREMENTS

Qualification	Qualification Code	Duration	Admission Requirements
Bachelor of Environmental Sciences Honours (Geography)	ESHESH (GEO)	1 year	• An applicant for an Honours degree programme must normally have obtained a Bachelors degree with an average mark of 60% in third year Geography modules or related modules approved by the HOD. There is a limited number of places and therefore meeting the minimum entry requirement does not guarantee a place. Applicants will be selected by a committee based on merit. Admission of students from other universities will be done through the approval by the HoD.
Bachelor of Environmental Sciences Honours (Ecology & Resource Management)	ESHESH (ERM)	1 year	• Requirement of 60% for both modules ERM3541 and ERM 3641 in the third year. There is a limited number of places and therefore meeting the minimum entry requirement does not guarantee a place. Applicants will be selected by a committee based on merit. Admission of students from other universities will be done through the approval by the HoD.

7.3.2. RULES FOR PROGRESSION

(a) Bachelor of Environmental Sciences Honours in Geography: SEMESTER MODULES: Students should register all first semester modules and a year-long GEO 5320: Research Project and Report/Dissertation.

MODULE CODES	PRE-REQUISITE
GEO 5120	Admission into ESHESH (Geo)
GEO 5121	Admission into ESHESH IGeo)
GEO 5122	Admission into ESHESH (Geo)

(b) SECOND SEMESTER MODULES: Students should select three modules. Of the three modules selected one should be from Physical Geography and another from Human Geography. The third module can be selected from either Physical or Human Geography. Pre-requisites apply.

MODULE CODES	PRE-REQUISITE
GEO 5220	GEO 3142 - or third-year equivalent in a related area.
GEO 5221	GEO 3242- or third-year equivalent in a related area.
GEO 5222	GEO 3143- or third-year equivalent in a related area.
GEO 5223	GEO 3243- or third-year equivalent in a related area.
GEO 5224	GEO 3244- or third-year equivalent in a related area.
GEO 5225	GEO 3144- or third-year equivalent in a related area.
GEO 5226	GEO 3145- or third-year equivalent in a related area.
GEO 5227	GEO 3241- or third-year equivalent in a related area.

7.3.3. ASSESSMENT CRITERIA

(a) Candidates will only be assessed in a specific module if they attended lectures, tutorials and prescribed practical satisfactorily and obtained a semester mark of at least 50%.
(b) A student must attain a minimum of 50% pass in **each** of the components of assessment. A student, who fails one of these components, will be allowed to repeat only that component. The written examination component will be conducted during the next normal examination period for that specific module.
(c) All written examinations will be taken only during official examination sessions**.**
(d) A candidate who fails two modules in the degree and obtains an aggregate of at least 50% may be admitted for assessment in those modules on one further sitting.
(e) To obtain the degree cum laude, a candidate must attain an aggregate of 75% or higher.

(f) Supplementary examinations will **not** be offered in the Hons degree.

(g) An Aegrotat Examination may be granted to a student who has been prevented from sitting for the examination:

(h) By illness on the day of the examination or assessment, or immediately before the examination or assessment, provided that a medical certificate from a registered medical practitioner is submitted to SENATE, and/or provided that the student's application is supported by the invigilator concerned or another responsible person; or

(i) As a result of domestic circumstances such as serious illness or death of a close relative during the examination or assessment, or other reasons, provided that the SENATE judges it to be a bona fide case, and the student can provide satisfactory proof of such extraordinary circumstances.

7.3.4. BSC HONS MODULE DESCRIPTIONS AND SPECIFIC RULES IN DEPARTMENT:

Bachelor of Environmental Sciences Honours (Geography) **[CODE: ESHESH (GEO)]**

- A maximum of seven (7) modules should be passed plus mini-dissertation (GEO 5720)
- Students should select three of the modules offered in the second semester: one should be from Physical Geography and another from Human Geography. The third module can be selected from either Physical or Human Geography.

Semester 1 (Compulsory modules)	Semester 2 (read note below)
GEO 5120 (16) General Research Methodology **GEO 5121** (16) Geographical Thought and Methodology **GEO 5122** (16) Advanced Quantitative and Qualitative Research Techniques **GEO 5320** (30) Research project and Report/ Dissertation	**GEO 5220** (16) Applied Geomorphology **GEO 5221** (16) Applied Climatology **GEO 5222** (16) Applied Biogeography **GEO 5223** (16) Sustainable Tourism, Tourism Policy and Management **GEO 5224** (16) Land Tenure and Rural Land Use **GEO 5225** (16) Advanced Population Dynamics and Demography **GEO 5226** (16) Urbanisation and Rural Studies **GEO 5227** (16) Geographical Information Systems & Remote Sensing
Total modules = 04 **Total credits = 78**	**Total modules = 03** **Total credits = 48**

GEO 5120 : General Research Methodology [Credits 16]
The module exposes students to the concept of research; research tools; proposal writing and the whole research process. The students are exposed to the logic of the dissertation / thesis; its structure, graphical presentation of data; discussion and analysis.

GEO 5221 : Geographic Thought & Methodology [Credits 16]
Introduction; Environmental determinism and possibilism, Quantitative Revolution. Khun's conceptualization of scientific revolution, Positivism, scientific nomological methods. Spatial theory and planning in South Africa before and after 1994. Maxist Science and structuralism influence on geography. Behavioral & Welfare Geography; Structuralism and Post Modernism, critical realism and neo-realism. Contributions of MBK Darkoh to geography and Env Sciences; Conservation or Development? A case of Lake Victoria. Transformation and decline of Miombo Woodlands in Eastern Tanzania, Global Warming and Potential Threats to Tourism. The realms of Physical Geography; Cognitive and Mental Maps; The Nature of Geographic Knowledge, Philosophical Concept in Physical Geography; The Science of Physical Geography, hypothesis formulation, Form and Process philosophy; Introduction to Systems Theory and Gaia Hypothesis.

GEO 5222 : Advanced Qualitative & Quantitative Research Techniques [Credits: 16]
The Advanced Qualitative and Quantitative Research Techniques (GEO5522) course is designed to enable students to collect data sensibly, manipulate and analyse the data, and interpret and draw conclusions based on qualitative and quantitative data. Candidates completing the course will become competent in methods of data collection, from the research design, sampling techniques, field interviews, including secondary data. The course also focuses on several important methods of analysing qualitative and quantitative data that are relevant to geographic problems. A variety of geographical problems in both the physical and cultural environments are used to illustrate course content. Several practical activities are arranged to demonstrate the use and application of each research technique. The course is meant to complement the Research Project (GEO5720) and prepare students for independent research and graduate programs.

GEO 5220 : Applied Geomorphology [Credits 16]
Prerequisite : *GEO 3142*
The module aims at assisting students to acquire advanced level understanding of analytical techniques for studying geomorphic processes. Introduction, perspectives and historical development and scope of applied geomorphology. Aspects of applied

geomorphology: land systems mapping, remote sensing, data sources for geomorphology in surveying and mapping: topographic and thematic (resource) mapping. Geomorphology and environmental/earth science: structural geomorphology, geomorphology, and vegetation mapping (Geobotany), geomorphology and development: geomorphology in site investigation and site planning, geomorphology in civil engineering, analytical and holistic geomorphologic mapping.

GEO 5221 : Applied Climatology [Credits 16]
Prerequisite : *GEO 3242*
Climatology has evolved into a major field with far reaching scientific and societal applications. The Applied Climatology course is designed for the advanced student with a sound background of the Atmospheric Sciences, Climatology and/or related disciplines. The course is divided into 6 main units. Firstly, the course deals with theoretical aspects governing atmospheric motions and the climate. Major weather systems and climate controls over southern Africa are also discussed next. The gathering of climate data from various observing platforms including their spatial and temporal resolutions are discussed with regards data quality. The later units deal with the science of climate change, observed trends and projections of the future climate. Practical applications of Atmospheric Science and Climatology to weather-sensitive sectors are explored extensively throughout the module. We will investigate the many faces of Applied Climatology, both from physical and cultural perspectives. Climate models will be used as a tool to answer some of the important questions about our climate.

GEO 5222 : Applied Biogeography [Credits 16]
Prerequisite : *GEO 3243*
The module content intends to promote scientific inquiry through quantitative and qualitative research approaches to solve biogeographical problems, critical evaluation of the physical environment, develop group work and leadership skills. The content focuses on tropical biogeography and species diversity, conservation of natural resources, nature reserves, man and the environment.

GEO 5223 : **Sustainable Tourism, Tourism Policy & Management [Credits: 16]**
Prerequisite : *GEO 3243*
The module is designed to provide an overview of sustainable tourism practices from a global perspective. The first part of the module deals with tourism development from three main priority areas (i.e., economic, environmental, and socio-cultural perspectives). Tourism policy and management principles are addressed from strategies analysis and evaluation. Students are trained to develop persuasive argument that displays independent thinking in responsible tourism development practices from different stakeholders (governments, Agencies, host communities, tour operators, tourists, Funding bodies and private sectors). Tourism's status is critical evaluated in terms of creation of job employment, utilisation of resource, community development, tourism policies and legislation, destination marketing and promotion, tourism impact and service industry.

GEO 5224 : Land Tenure & Rural Land use [Credits 16]
Prerequisite : *GEO 3244*
The module aims at studying and appraising the system of land ownership in South Africa and its role in rural development. The module covers the historical background and land ownership in South Africa; Indigenous African Land Tenure systems; Private ownership of land; land reform in South Africa-policy and implementation; Evaluation of the drivers of land reform; Land reform as part of comprehensive rural development programme; Strategies for rural development.

GEO 5225 : Advanced Population Dynamics & Demography [Credits 16]
Prerequisite : *GEO 3244*
The module covers various ways of studying population, conceptual frameworks, models and theories. At the end of the module, students are able to identify the various ways of studying population; formulate conceptual models of population related issues; distinguish between conceptual frameworks, models and theories; apply models and theories used in studies of the interrelationships between population and the environment; and apply population and demographic knowledge to explain spatial problems and relating to social development.

GEO 5226 : Urbanisation & Rural studies [Credits 16]
Prerequisite *: GEO 3142*
The module provides an overview of the rapid urbanisation process. First part of the module looks at the global distribution of the world cities in terms of their sizes and development paths. Theoretical perspectives on sustainable urban development and the applicability of classical theories of sizes and spacing is put in perspective. Urban sprawl and social/ rural transformation constitute the critical part of the module. Particular emphasis is placed on strategies to deal with urbanisation related challenges from the global south while exposing students to the broader understanding of spatial/ geographic disparities between the global south and the global north countries. Local government mandate and their constrains are mainly dealt with from a south African perspective to strengthen student capacity to integrate theory with practices.

GEO 5227 : Geographical Information Systems & Remote sensing [Credits: 16]
Prerequisite *: GEO 3241*
The module is designed to enable students to acquire GIS and Remote sensing skills within the GIS and Image Processing software. *Specifically, the module covers* GIS basic concepts and understanding of GIS data structures and Database design; Geostatistical and Spatial data modelling; participatory GIS; GIS implementation and project management and GIS applications. The module also deals with Remote sensing systems; spectral signatures and their interpretation; image procession and interpretation; remote sensing applications.

GEO 5720: Research Project & Report/Dissertation [Credits 30]

Bachelor of Environmental Sciences Honours (ERM) **[CODE: ESHESH (ERM)]**

Seven (7) modules should be passed plus mini-dissertation (ERM 5740)

Semester 1	Semester 2	Both semesters
ERM 5541/5141 (15) Land Information Technology **ERM 5542 /5142**(15) Pollution Modelling and Control **ERM 5543/5143** (15) Resource and Environmental Economics **ERM 5544/5144** (15) Rangeland Management	**ERM 5641/5241** (15) Habitat and Biodiversity Management **ERM 5642/5242** (15) Ecotoxicology **ERM 5643/5243** (15) Energy Resource Management	**ERM 5740** (30) Research Methods and Mini-Dissertation
Total modules = 04 **Total credits = 60**	**Total modules = 3** **Total credits = 45**	**Total modules = 1** **Total credits = 30**

ERM 5141: Land Information Technology [Credits 15]
Prerequisite : ERM 3141
This module covers: remote sensing; ground truthing; land information systems; spatial analysis and modelling; applications.

ERM 5142 : Pollution Modelling and Control [Credits 15]
Prerequisite : ERM 3141
This module covers: environmental impact assessment of pollution; techniques for modelling air, water and land pollution; pollution abatement technologies; legal control of pollution; economic policies for the control of pollution; mechanical, chemical and biological control strategies; cost-benefit analysis of pollution control strategies; pollution control in South Africa; reclamation/rehabilitation of polluted environments; case studies of reclamation of polluted environments in South Africa.

ERM 5143 : Resource and Environmental Economics [Credits 15]
Prerequisite : *ERM /3141*
This module covers: basic principles of economics; market allocation; capitalism; supply and demand; economic efficiency and market failure; cartels; externalities; common pool resources; equity; property rights; cost and benefit analysis; net present value; non-market benefits; valuation methods; direct and indirect costs; regulatory processes; fisheries; special topics.

ERM 5144 : Rangeland Management [Credits 15]
Prerequisite : *ERM 3141*
This module covers: scope and goals of rangeland management; range carrying capacity evaluation; range improvement strategies; paddocking and grazing management system; strategies of water supply in rangeland management; ranch establishment and management; use of fire in manipulating successional process in rangeland ecosystems; range problem and possible solutions in arid and semi-arid lands; traditional range management system in Eastern and Southern Africa; problems and solutions.

ERM 5241 : Habitat and Biodiversity Management [Credits 15]
Prerequisite : *ERM 3241*
This module covers: patterns in biodiversity; species-area relationships; species abundance distributions; measuring biodiversity; diversity indices; rarity; endemism; α, β and γ diversity; small population effects; island biogeography; metapopulations; reserve selection and management; the SLOSS debate; types of reserves; wetlands case study.

ERM 5242 : Ecotoxicology [Credits 15]
Prerequisite : *ERM 3241*
This module covers: introduction to toxicology and ecotoxicology; categorisation of substances on the basis of toxicity, persistence and bioaccumulation; consent level sets; assessment of toxicity risk; risk of pollutants in contaminated lands; risk of pollution in drinking water; risk of pollution in gases and vapours; teragenesis, mutagenesis, carcinogenesis and immune system defects; analysis of ecotoxicity of pesticides and heavy metal.

ERM 5243 : Energy Resource Management [Credits 15]
Prerequisite : *ERM 3241*
This module covers: analysis of renewable and non-renewable energy sources; patterns of demand and supply of energy; prospecting, exploitation and marketing of oil and coal energy resources; conservation of fossil fuels; fuel-wood and biomass energy; geothermal energy; solar energy; wind energy; hydro-electric energy and nuclear energy; strategies for the promotion and maintenance of sustainability of energy resource; analysis of world energy policies and trade; energy policies and trade in SADC countries, the fuel-wood crisis in Africa.

7.4. MASTERS QUALIFICATIONS OFFERED IN THE DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL SCIENCES ARE ONLY BY RESEARCH

7.4.1 ADMISSION REQUIREMENTS

Qualification	Qualification Code	Duration	Admission Requirements
Master of Environmental Science (Geography)	ESMESG	2 years	• A 4-years BSc or BSc Honours in Geography and/or Environmental Science or other related fields of study in the Natural or Physical Sciences with an average of 65%, an upper-second class for a class-based systems with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE. • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.
Master of Environmental Sciences (Ecology and Resource Management)	ESMERM	2 years	• A 4-years BSc or BSc Honours in Geography and/or Environmental Science or other related fields of study in the Natural or Physical Sciences with an average of 65%, an upper-second class for a class-based systems with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE. • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

7.4 2. RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title and topic of the proposed dissertation, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and the Faculty Higher Degrees Committee final approval. (b) The Research proposal, registration and ethics must be approved by the Deprtments Higher Degrees Committee and then send for final approval to the Faculty Higher Degrees Committee and UHDC. (c) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the Master's degree may be conferred only after the candidate has been registered for a period of at least TWO years fulltime. (d) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE. (e) The Research MSc degree is conferred based on a dissertation and an examination, or a dissertation only, as determined by the Faculty Academic Board. (f) The taught MSc degree is conferred based on a mini dissertation and a component of taught modules which must all be passed as per degree requirements (g) The Head of Department may prescribe certain ancillary modules which must be enrolled or passed before the date of the Master's examination. (h) The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture. (i) SENATE may, at any time, suspend or cancel the registration of any student who, in its view, is not making satisfactory progress.

	(j) Students who wish to defer their studies at **any stage <u>MUST APPLY</u>** to the relevant department. If granted, such deferment will be for **<u>a maximum period of one year</u>**, after which a further application must be submitted. Deferment will, **<u>at most</u>**, be granted twice. (k) Before registration for 2nd or further years, the student must write a full progress report for the year passed which is signed by the supervisor and the HOD to show progress, which will be approved /not approved by the Executive Dean. This progress report will count as the last quarterly report of the passed year for the student. **<u>No</u>** student will be allowed to register without the approval of the Executive Dean
ASSESSMENT CRITERIA	(a) Procedures as per post-graduate policies and guidelines will be followed – this includes the agreement between the student and supervisor that must be in placed as well as the quarterly reports that must be send to the Faculty Research office as proof of student's progress (b) Quarterly progress reports are compulsory

7.5. <u>DOCTORAL QUALIFICATIONS OFFERED BY THE DEPARTMENT OF GEOGRAPHY AND ENVIRNMENTAL SCIENCES ARE ONLY BY RESEARCH</u>

7.5.1 ADMISSION REQUIREMENTS

Qualification	Qualification code	Duration	Admission requirements
PhD (Geography)	**ESPDPG**	3 years	(a) A MSc in Geography/Environmental Sciences/Ecology or other related fields of study in the Natural or Physical Sciences with a minimum mark of 65% OR equivalent status conferred by SENATE. (b) An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. (c) Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN
PhD (Environmental Sciences)	**ESPPES**	3 years	(a) A MSc in Geography/Environmental Sciences/Ecology or other related fields of study in the Natural or Physical Sciences with a minimum mark of 65% OR equivalent status conferred by SENATE. (b) An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. (c) Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

7.5.2 RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title and topic of the proposed thesis, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and then the Faculty Higher Degrees Committee for approval. (b) The Research proposal, registration of project and ethics application must be approved by the Departments and Faculty's Higher Degrees Committee before final approval by the UHDC. (c) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the degree may be conferred only after the candidate has been registered for a period of at least THREE years fulltime.

	(d) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE.
ASSESSMENT CRITERIA	(a) Procedures as per Postgraduate policy guidelines will be followed. This will include the agreement between the supervisor and the doctoral student and the quarterly progress reports that must be submitted in time to the Faculty Research office (b) External examination of thesis will be done as per Post Graduate policies (c) Viva Voce as per school postgraduate guidelines through the office of the Executive Dean. If a student fails the Viva Voce, the degree will not be awarded. (d) Quarterly progress reports are compulsory

SECTION 8:

DEPARTMENT: MATHEMATICAL AND COMPUTATIONAL SCIENCES

8.1. QUALIFICATIONS OFFERED BY THE DEPARTMENT OF MATHEMATICAL AND COMPUTATIONAL SCIENCES

Generic BSc degrees (BSc):

• BSc (MATHEMATICS AND APPLIED MATHEMATICS)		CODE: MNBBSF
• BSc (FINANCIAL MATHEMATICS AND APPLIED MATEMATICS)		CODE: MNBBSG
• BSc (MATHEMATICS AND PHYSICS)		CODE: MNBBSH
• BSc (MATHEMATICS AND STATISTICS)		CODE: MNBBSI
• BSc (CHEMISTRY AND MATHEMATICS)		CODE: MNBBSK
• BSc (COMPUTER SCIENCE)		CODE: MNBBSP
• BSc (COMPUTER SCIENCE AND MATHEMATICS)		CODE: MNBBSQ

BSc Hons degrees (BSc.Hons)

• BSc HONS (MATHEMATICS)		CODE: MNHSHM
• BSc HONS (APPLIED MATHEMATICS)		CODE: MNHHAM
• BSc HONS (COMPUTER SCIENCE)		CODE: MNHHCS
• BSc HONS (STATISTICS)		CODE: MNHSHS

MSc degrees (MSc) by research:

• MSc (MATHEMATICS)	Project: MAT 6300	CODE: MNMMSM
• MSc (APPLIED MATHEMATICS)	Project: MAT 6300	CODE: MNMSAM
• MSc (STATISTICS)	Project: STA 6300	CODE: MNMMSS

MSc degrees (MSc) by mini project:

• MASTERS (e-SCIENCE)	CODE: MNMSES

PhD degrees (PhD):

• PhD MATHEMATICAL SCIENCES (STATISTICS)	Project: STA 7300	CODE: MNPPST
• PhD MATHEMATICAL SCIENCES (MATHEMATICS)	Project: MAT 7300	CODE: MNPMSM
• PhD APPLIED MATHEMATICS	Project: MAT 7300	CODE: MNPPAM

8.2. GENERIC BACHELOR OF SCIENCE DEGREE (BSc) OFFERED BY THE DEPARTMENT OF MATHEMATICAL AND COMPUTATIONAL SCIENCES [CREDITS = 360]

8.2.1. ADMISSIONS REQUIREMENTS, RULES FOR PROGRESSION AND ASSESSMENT CRITERIA FOR THE BSc QUALIFICATIONS

ADMISSIONS REQUIREMENTS	(a) Candidates wishing to enroll for a Generic BSc degree in the Department of Biological Sciences in any of the undergraduate qualifications listed, must have obtained a minimum admission requirement in a National Senior Certificate (NSC) as certified by the Council for General and Further Education and Training (Umalusi) with an achievement rating of **4** (adequate achievement, 50-59%) or better in **each** of the following four recognised 20-credit NSC subjects: • English • Mathematics • Physical Science • Life Sciences (b) Any other related subject as judged by the HOD of the responsible department and approved by the Executive Dean of the Faculty (c) Candidates may be subjected to a selection procedure as determined by the Faculty board. (d) Equivalent FET Level 4 qualifications in any of the above subjects may also be considered. (e) Students from the Extended BSc Degree Programme should have obtained 120 credits from the 12 modules registered for, before admission to the listed mainstream degree.

RULES FOR PROGRESSION	**Students from the foundation year:** (a) All outstanding Foundation year modules **must be** registered for and passed during year 2 of the extended programme. (b) Students will not be allowed to move to year 3 of the extended programme or take any second-year mainstream modules if they still have **outstanding extended/foundation 1st year modules**. (c) A third-year extended programme student who has passed 60% of his/her second-year modules **may only** register third year modules whose Pre-requisites have been met, subject to the approval of the Head of Department and the Executive Dean. (d) Students may not select modules that clash on the lecturing and practical timetables. (e) No curriculum change, whether within or from outside the Faculty, will be recognized unless approved by the Executive Dean. (f) A full-time student may take a maximum of 32 credits over and above the minimum 360 credits required for the degree, **subject to the approval of the Head of Department and the Executive Dean**. (g) Students can register ONLY for modules for which **ALL** pre-requisites have been satisfied. (h) Students retain credits for all modules passed. (i) To qualify for a BSc degree in the Faculty, students must obtain a minimum of half of their credits in a learning stream within the Faculty of Sciene, Engineering and Agriculture. **Students registered for 3 year BSc degree:** (a) A student **may only progress to the second-year level** when she/he has passed 60% of the 1st year modules in the mainstream BSc degree (b) To progress to the third-year level, a student must have passed **ALL** first- and second-year modules. (c) Students may not select modules that clash on the lecturing and practical timetables. (d) No curriculum change, whether within or from outside the Faculty, will be recognized unless approved by the HOD and the Executive Dean. (e) A full-time student may take a maximum of 32 credits over and above the minimum 360 credits required for the degree, **subject to the approval** of the Head of Department and the Executive Dean. (f) Students can register **ONLY** for modules for which **ALL** Pre-requisites have been satisfied**.** (g) Students retain credits for all modules passed. (h) To qualify for a BSc degree in the School of Mathematical and Natural Sciences, students **must obtain a minimum** of half of their credits in a learning stream within this School. (i) To obtain a degree from the School, students must have earned at least 360 credits including all core and fundamental modules in one of the generic Bachelor of Science qualifications. Departments may prescribe additional credits **provided these do not exceed** 32 credits. (j) The minimum registration period for a BSc. degree is three years and the maximum is n+2.
ASSESSMENT CRITERIA	(a) Continuous Assessment will be determined by the Department and approved by the Faculty Board and consist of tests, practical sessions and tests, tutorials, projects, assignments and reports. (b) Students will write examinations at the end of each semester on condition that they qualify to do so. (c) The minimum final pass mark in any module is 50%. (d) To obtain the degree or diploma cum laude, a candidate must attain an aggregate of 75% or higher.

8.2.2. THE GENERIC BSc QUALIFICATIONS OFFERED IN THE DEPARTMENT OF MATHEMATICAL AND COMPUTATIONAL SCIENCES

BSc (MATHEMATICS AND APPLIED MATHEMATICS) [CODE: MNBBSF]

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematic Foundations I **COM 1122** (8): Introduction to Computer Systems **PHY 1121** (8): Mechanics **STA 1142** (8): Introductory Probability **ECS 1141** (10): English Communication Skills (Generic Module)	**COM 1124** (8): Fundamentals of Computer Architecture **PHY 1122** (8): Waves and Optics I **STA 1141** (8): Introduction to Statistics	**124**
	2	**MAT 1241** (8): Integral Calculus **MAT 1242** (8): Mathematics Foundations II **MAT 1246** (8): Mechanics I **MAT 1247** (8): Numerical Analysis I **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**PHY 1223** (8): Properties of Matter Thermal Physics **PHY 1224** (8): Electricity and Magnetism **STA 1241** (8): Elementary Statistical Methods I- Introductory Interference **STA 1242** (8): Elementary Statistical Methods II – Correlation and Regression	
	Year module	**COM 1321** (16): Object Oriented Programming		
Year 2 **NQF Level 6**	**1**	**MAT 2141** (10): Linear algebra **MAT 2142** (10): Multivariable Calculus **MAT 2148** (10): Mathematical Modelling I **STA 2141** (10): Probability Distributions	**COM 2123** (10): Imperative Programming **COM 2128** (10): Artificial Intelligence Fundamentals **COM 2129** (10): Database Fundamentals **STA 2142** (10): Multiple Regression	**120**
	2	**MAT 2241** (10): Real Analysis I **MAT 2242** (10): Ordinary Differential Equations I **MAT 2247** (10): Numerical Analysis II **MAT 2248** (10): Vector Analysis **STA 2241** (10): Statistical Computing	**COM 2216** (10): Reasoning about Programs **COM 2224** (10): Algorithms and Data Structures **COM 2229** (10): Systems Analysis **STA 2242** (10): Sampling Techniques	
Year 3 **NQF Level 7**	**1**	**MAT 3141** (14): Real Analysis II **MAT 3147** (14): Partial Differential Equations **MAT 3149** (14): Ordinary Differential Equations II	**STA 3141** (14): Statistical Interference **STA 3142** (14): Industrial Statistics **MAT 3142** (14): Group Theory	**126**
	2	**MAT 3241** (14): Complex Analysis **MAT 3246** (14): Mechanics II **MAT 3247** (14): Numerical Analysis III	**COM 3221** (14): Advanced Algorithms **MAT 3242** (14): Rings and Fields **MAT 3243** (14): Graph Theory **MAT 3244** (14): Continuum Mechanics **MAT 3248** (14): Mathematical Modelling II **MAT 3249** (14): Geometry	

In year 1:
- Take modules in total of 16 credits from the elective module list
- The compulsory year module must be registered in the 1st semester

In year 2:
- Take modules in total of 30 credits from the elective module list

In year 3:
- Take modules in total of 42 credits from the elective module list

BSc (FINANCIAL MATHEMATICS AND APPLIED MATHEMATICS) [CODE: MNBBSG]

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematics Foundation I **STA 1142** (8): Introductory Probability **PHY 1121** (8): Mechanics **COM 1122** (8): Introduction to Computer Systems **ECS 1141** (10): English Communication Skills (Generic Module)	**COM 1124** (8): Fundamentals of Computer Architecture **ECO 1141** (12): Basic Economics **STA 1141** (8): Introduction to Statistics	**124**
	2	**MAT 1241** (8): Integral Calculus **MAT 1242** (8): Mathematics Foundations II **MAT 1246** (8): Mechanics I **MAT 1247** (8): Numerical Analysis I **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**STA 1241** (8): Elementary Statistical Methods I – Introductory Interference **STA 1242** (8): Elementary Statistical Methods II – Correlation and Regression **ECO 1241** (12): Basic Macro-economics	
	Year module	**COM 1321** (16): Object Oriented Programming		
Year 2 **NQF Level 6**	**1**	**MAT 2141** (10): Linear algebra **MAT 2142** (10): Multivariable Calculus **MAT 2148** (10): Mathematical Modelling I **STA 2141** (10): Probability Distributions	**COM 2123** (10): Imperative Programming **COM 2128** (10): Artificial Intelligence Fundamentals **COM 2129** (10): Database Fundamentals **ECO 2141** (15): Intermediate Micro-economics **STA 2142** (10): Multiple Regression	**120**
	2	**MAT 2241** (10): Real Analysis I **MAT 2242** (10): Ordinary Differential Equations I **MAT 2247** (10): Numerical Analysis II **STA 2241** (10): Statistical Computing	**COM 2216** (10): Reasoning about Programs **STA 2242** (10): Sampling Techniques **ECO 2241** (15): Intermediate Macro-economics	
Year 3 **NQF Level 7**	**1**	**MAT 3141** (14): Real Analysis II **MAT 3146** (14): Finance Mathematics **MAT 3147** (14): Partial Differential Equations **MAT 3149** (14): Ordinary Differential Equations II **MAT 3156** (14): Statistical Finance Mathematics	**STA 3141** (14): Statistical Inference	**126**
	2	**MAT 3247** (14): Numerical Analysis III **MAT 3256** (14): Advanced Finance Mathematics	**MAT 3241** (14): Complex Analysis **MAT 3244** (14): Continuum Mechanics **MAT 3248** (14): Mathematical Modelling II **MAT 3249** (14): Geometry **STA 3241** (14): Time Series Analysis	

In year 1: - Take modules in total of 16 credits from the elective module list
- The compulsory year module must be registered in the 1st semester

In year 2: - Take modules in total of 40 credits from the elective module list

In year 3: - Take modules in total of 28 credits from the elective module list

BSc (MATHEMATICS AND PHYSICS) **[CODE: MNBBSH]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**PHY 1121** (8): Mechanics **PHY 1122** (8): Waves and Optics I **MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematics Foundations I **CHE 1140** (16): General Chemistry for the Applied Sciences **ECS 1145** (10): English Communication Skills	**COM 1122** (8): Introduction to Computer Systems **COM 1124** (8): Fundamentals of Computer Architecture **STA 1141** (8): Introduction to Statistics **STA 1142** (8): Introductory Probability	**128**
	2	**PHY 1223** (8): Properties of Matter and Heat **PHY 1224** (8): Electricity and Magnetism **MAT 1241** (8): Integral Calculus **MAT 1242** (8): Mathematics Foundations II **MAT 1247** (8): Numerical Analysis I **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**STA 1241** (8): Elementary Statistical Methods I – Introductory Interference **STA 1242** (8): Elementary Statistical Methods II – Correlation and Regression	
	Year module	**COM 1321** (16): Object Oriented Programming		
Year 2 **NQF Level 6**	**1**	**PHY 2121** (10): Classical Mechanics **PHY 2122** (10): Waves and Optics II **MAT 2141** (10): Linear Algebra **MAT 2142** (10): Multivariable Calculus	**MAT 2148** (10): Mathematical Modelling I **COM 2123** (10): Imperative Programming **COM 2128** (10): Artificial Intelligence Fundamentals **COM 2129** (10): Database Fundamentals **STA 2141** (10): Probability Distributions	**120**
	2	**PHY 2223** (10): Electrodynamics **PHY 2224** (10): Modern Physics **MAT 2241** (10): Real Analysis I **MAT 2242** (10): Ordinary Differential Equations I **MAT 2247** (10): Numerical Analysis II **MAT 2248** (10): Vector Analysis	**CHE 2220** (10): Analytical Chemistry: Classical Techniques **CHE 2223** (10): Physical Chemistry I **STA 2241** (10): Statistical Computing	
Year 3 **NQF Level 7**	**1**	**PHY 3121** (14): Atomic and Nuclear Physics **PHY 3122** (14): Solid State Physics **MAT 3141** (14): Real Analysis II **MAT 3147** (14): Partial Differential Equations **MAT 3149** (14): Ordinary Differential Equations II	NONE	**126**
	2	**PHY 3223** (14): Thermodynamics and Statistical Mechanics **PHY 3224** (14): Quantum Mechanics **MAT 3241** (14): Complex Analysis	**MAT 3244** (14): Continuum Mechanics **MAT 3247** (14): Numerical Analysis III **MAT 3248** (14): Mathematical Modelling II	

In year 1:
- Take modules in total of 8 credits from the elective module list
- The compulsory year module must be registered in the 1st semester

In year 2:
- Take modules in total of 20 credits from the elective module list

In year 3:
- Take modules in total of 14 credits from the elective module list

BSc (MATHEMATICS AND STATISTICS) **[CODE: MNBBSI]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematics Foundations I **PHY 1121** (8): Mechanics **STA 1141** (8): Introduction to Statistics **STA 1142** (8): Introductory Probability **ECS 1145** (10): English Communication Skills	**COM 1122** (8): Introduction to computer Systems **COM 1124** (8): Fundamentals of Computer Architecture **PHY 1122** (8): Waves and Optics I	**124**
	2	**MAT 1241** (8): Integral Calculus **MAT 1242** (8): Mathematics Foundations II **STA 1241** (8): Elementary Statistical Method I - Introductory Interference **STA 1242** (8): Elementary Statistical Methods II - Correlation and regression **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**MAT 1246** (8): Mechanics I **MAT 1247** (8): Numerical Analysis I **PHY 1223** (8): Properties of Matter and Heat **PHY 1224** (8): Electricity and Magnetism	
	Year module	**COM 1321** (16): Object Oriented Programming		
Year 2 **NQF Level 6**	**1**	**MAT 2141**(10): Linear algebra **MAT 2142** (10): Multivariable Calculus **STA 2141** (10): Probability Distributions **STA 2142** (10): Multiple Regression	**COM 2123** (10): Imperative Programming **COM 2128** (10): Artificial Intelligence Fundamentals **COM 2129** (10): Database Fundamentals **MAT 2148** (10): Mathematical Modelling I	**120**
	2	**MAT 2241** (10): Real Analysis I **MAT 2242** (10): Ordinary Differential Equations I **STA 2241** (10): Statistical Computing **STA 2242** (10): Sampling Techniques	**COM 2216** (10): Reasoning about Programs **COM 2224** (10): Algorithms and Data Structures **COM 2229** (10): Systems Analysis **MAT 2247** (10): Numerical Analysis II **MAT 2248** (10): Vector Analysis	
Year 3 **NQF Level 7**	**1**	**MAT 3141** (14): Real Analysis II **STA 3141** (14): Statistical Inference	**STA 3142** (14): Industrial Statistics **STA 3143** (14): Introduction to Research and Official Statistics **MAT 3142** (14): Group Theory **MAT 3146 (**14): Finance Mathematics **MAT 3147** (14): Partial Differential Equations **MAT 3156** (14): Statistical Finance Mathematics	**126**
	2	**MAT 3241** (14): Complex Analysis **STA 3242** (14): Experiential design	**STA 3241** (14): Time Series Analysis **STA 3243** (14): Multivariate Methods **MAT 3247** (14): Numerical Analysis III **MAT 3248** (14): Mathematical Modelling II **MAT 3256** (14): Advanced Financial Mathematics	

In year 1: - Take modules in total of 16 credits from the elective module list
- The compulsory year module must be registered in the 1st semester

In year 2: - Take modules in total of 40 credits from the elective module list

In year 3: - Take modules in total of 70 credits from the elective module list from either MAT or STA configured as: 28 credits from STA and 42 credits from MAT **or** 28 credits from MAT and 42 credits from STA

BSc (CHEMISTRY AND MATHEMATICS) **[CODE: MNBBSK]**

YEAR	SEMESTER	COMPULSAORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**CHE 1140** (16): General Chemistry for the Applied Sciences **MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematics Foundation I **PHY 1121** (8): Mechanics **PHY 1122** (8): Waves and Optics I **COM 0110** (4): Computer Literacy **ECS 1141** (10): English Communication Skills (Generic Module)	**BIO 1141** (12): The Tree of Life **BIO 1142** (12): Cell Biology **COM 1321** (16): Object Oriented Programming **[Please note: this is a year module]** **STA 1141** (8): Introduction to Statistics	**136**
	2	**CHE 1221** (8): Inorganic Chemistry I **CHE 1222** (8): Organic Chemistry I **MAT 1241** (8): Integral Calculus **MAT 1242** (8): Mathematics Foundation II **PHY 1223** (8): Properties of Matter and Heat **PHY 1224** (8): Electricity and Magnetism **COM 0210** (4): Computer Literacy **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**STA 1241** (8): Elementary Statistical Method I - Introductory Interference **MAT 1247** (8): Numerical Analysis I **BIO 1243** (16): Ecology, Adaptation and Evolution	
Year 2 **NQF Level 6**	**1**	**CHE 2121** (10): Inorganic Chemistry II **CHE 2122** (10): Organic Chemistry II **MAT 2141** (10): Linear Algebra **MAT 2142** (10): Multivariable Calculus	**COM 2123** (10): Imperative Programming **COM 2128** (10): Artificial Intelligence Fundamentals **COM 2129** (10): Database Fundamentals **PHY 2121** (10): Classical Mechanics **PHY 2122** (10): Waves and Optics II	**120**
	2	**CHE 2220** (10): Analytical Chemistry: Classical Techniques **CHE 2223** (10): Physical Chemistry I **MAT 2241** (10): Real Analysis I **MAT 2242** (10): Ordinary Differential Equations I	**COM 2216** (10): Reasoning about Programs **COM 2229** (10): Systems Analysis **PHY 2223** (10): Electrodynamics **PHY 2224** (10): Modern Physics **MAT 2247** (10): Numerical Analysis II	
Year 3 **NQF Level 7**	**1**	**CHE 3120** (14): Analytical Chemistry: Instrumental Techniques **CHE 3123** (14): Physical Chemistry II **MAT 3141** (14): Real Analysis II **MAT 3142** (14): Group Theory	**MAT 3147** (14): Partial Differential Equations	**126**
	2	**CHE 3221** (14): Inorganic Chemistry III **CHE 3222** (14): Organic Chemistry III **MAT 3241** (14): Complex Analysis **MAT 3248** (14): Mathematical Modelling II	**MAT 3242** (14): Rings and Fields **MAT 3247** (14): Numerical Analysis III	

In year 1:
- Take modules in total of 16 credits from the elective module list
- Take either COM 0110 **OR** COM 0210
- Please note that the **COM 1321** module is an elective and a year module which must be registered in the 1st semester

In year 2:
- Take modules in total of 40 credits from the elective module list

In year 3:
- Take modules in total of 14 credits from the elective module list

BSc (COMPUTER SCIENCE) **[CODE: MNBBSP]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**COM 1122** (8): Introduction to Computer Systems **COM 1124** (8): Fundamentals of Computer Architecture **MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematics Foundations I **ECS 1141** (10): English Communication Skills (Generic Module)	**PHY 1121** (8): Mechanics **PHY 1122** (8): Waves and Optics I **STA 1141** (8): Introduction to Statistics	**138**
	2	**COM1226** (8): Computer Technology **MAT1241** (8): Integral Calculus **MAT1242** (8): Mathematics Foundations II **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**PHY 1223** (8): Properties of Matter and Heat **PHY 1224** (8): Electricity and Magnetism **STA 1241** (8): Elementary Statistical Method I-Introductory Interference	
	Year module	**COM 1321** (16): Object Oriented Programming		
Year 2 **NQF Level 6**	**1**	**COM 2120** (10): Digital Design Techniques **COM 2123** (10): Imperative Programming **COM 2125** (10): Operating Systems **COM 2126** (10): Human-Computer Interaction **COM 2128** (10): Artificial Intelligence Fundamentals **COM 2129** (10): Database Fundamentals	NONE	**120**
	2	**COM 2216** (10): Reasoning about programs **COM 2224** (10): Algorithms and Data Structures **COM 2226** (10): Data Communication and Computer Networks **COM 2228** (10): Contemporary Object-Oriented Concepts **COM 2229** (10): Systems Analysis	NONE	
	Year module	**COM 2301** (10): Computer Science Lab		
Year 3 **NQF Level 7**	**1**	**COM 3120** (14): Software Engineering I **COM 3121** (14): Distributed Operating Systems **COM 3128** (14): Systems Design and Implementation	NONE	**126**
	2	**COM 3217** (14): Professional Issues in Computing and Information Technology **COM 3220** (14): Software Engineering II **COM 3221** (14): Advanced Algorithms **COM 3226** (14): Artificial Intelligence **COM 3227** (14): Evaluation of Information Systems **COM 3229** (14): Database Design and Implementation	NONE	

In year 1:
- Take modules in total of 32 credits from the elective module list
- The compulsory year module must be registered in the 1st semester

In year 2: The compulsory year module must be registered in the 1st semester

BSc (COMPUTER SCIENCE AND MATHEMATICS) **[CODE: MNBBSQ]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**COM 1122** (8): Introduction to Computer Systems **COM 1124** (8): Fundamentals of Computer Architecture **MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematics Foundation I **STA 1142** (8): Introductory Probability **ECS 1141** (10): English Communication Skills (Generic Module)	**PHY 1121** (8): Mechanics **PHY 1122** (8): Waves and Optics I **STA 1141** (8): Introduction to Statistics	**132**
	2	**MAT 1241** (8): Integral Calculus **MAT 1242** (8): Mathematics Foundations II **COM 1226** (8): Computer Technology **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**MAT 1247** (8): Numerical Analysis I **PHY 1223** (8): Properties of Matter and Heat **PHY 1224** (8): Electricity and Magnetism **STA 1241** (8): Elementary Statistical Method I – Introductory Interference	
	Year module	**COM 1321** (16): Object Oriented Programming		
Year 2 **NQF Level 6**	**1**	**COM 2123** (10): Imperative Programming **COM 2129** (10): Database Fundamentals **MAT 2141** (10): Linear Algebra **MAT 2142** (10): Multivariable Calculus **MAT 2148** (10): Mathematical Modelling I	**COM 2120** (10): Digital Design Techniques **COM 2125** (10): Operating Systems **COM 2126** (10): Human-Computer Interaction **COM 2128** (10): Artificial Intelligence Fundamentals **STA 2141** (10): Probability Distribution	**120**
	2	**COM 2224** (10): Algorithms and Data Structures **COM 2226** (10): Data Communication and Computer Networks **MAT 2241** (10): Real Analysis I **MAT 2242** (10): Ordinary Differential Equations I	**COM 2216** (10): Reasoning about programs **COM 2228** (10): Contemporary Object-Oriented Concepts **COM 2229** (10): Systems Analysis **STA 2241** (10): Statistical Computing **MAT 2247** (10): Numerical Analysis II	
	Year module	**COM 2301** (10): Computer Science Lab		
Year 3 **NQF Level 7**	**1**	**MAT 3141** (14): Real Analysis II **MAT 3142** (14): Group Theory	**MAT 3147** (14): Partial Differential Equations **COM 3120** (14): Software Engineering I **COM 3121** (14): Distributed Operating Systems **COM 3128** (14): Systems Design and Implementation	**112**
	2	**COM 3217** (14): Professional Issues in Computing and Information Technology **COM 3221** (14): Advanced Algorithms **COM 3229** (14): Database Design and Implementation **MAT 3241** (14): Complex Analysis **MAT 3243** (14): Graph Theory	**MAT 3242** (14): Rings and Fields **MAT 3247** (14): Numerical Analysis III **MAT 3248** (14): Mathematical Modelling II **MAT 3249** (14): Geometry **COM 3226** (14): Artificial Intelligence **COM 3227** (14): Evaluation of Information Systems	

In year 1:
- Take modules in total of 32 credits from the elective module list
- The compulsory year module must be registered in the 1st semester

In year 2:
- The compulsory year module must be registered in the 1st semester
- Take modules in total of 40 credits from the elective module list

In year 3:
- Take modules in total of 14 credits from the elective module list

8.2.3. DESCRIPTION OF UNDERGRADUATE MODULES OFFERED BY THE DEPARTMENT OF MATHEMATICAL AND COMPUTIONAL SCIENCES PER SEMESTER

(a) SERVICE MODULES:

FIRST YEAR MODULES – SEMESTER 1:

MAT 1143 : Mathematics for Biological, Earth and life Sciences I [credits 8]
Functions, Linear Programming, Limits, Continuity, The derivatives and differentiation, Exponential and Logarithmic functions, Curve Sketching, Optimization and other applications of derivatives, Trigonometric Functions, Definite and indefinite Integrals, Applications of the definite to Areas, Volumes, and Centers of Mass.

MAT 1145 : Business Mathematics I [credits 12]
Linear equations: Graphs of linear equations, algebraic solution of simultaneous linear equations, supply and demand analysis. National income determination. Revenue, cost, profit, exponential and natural logarithm functions. Mathematics of finance: compound interest, sinking fund, loan repayment, annuity and investment appraisal. Differentiation: rules of differentiation, marginal functions, optimization of economic functions and the derivatives of the exponential and natural logarithm functions.

MAT 1149 : Mathematics for Planners [credits 12]
Basic concepts in mensuration, trigonometry; geometry, linear and matrix algebra; population growth models. Descriptive Statistics; sampling and collection of data, frequency distributions and graphical representations. Descriptive measures of location and dispersion. Probability and inference and Statistical distributions. Sampling frames, techniques and distributions. Estimation theory and hypothesis testing of sampling averages and proportions.

STA 1148 : **Basic Statistics (Business, Economics and the Social Sciences) [credits 8 credits]**
Overview of Statistics; Scales of measurement. Descriptive Statistics Frequency distribution and graphs; Measures of central tendency; Measures of variation. The Normal distribution. Central limit theorem.

STA 1149 : Basic Statistics (for the Natural and Applied Sciences) [credits 8]
Overview of Statistics; Scales of measurement. Descriptive Statistics Frequency distribution and graphs; Measures of central tendency; Measures of variation. The Normal distribution. Central limit theorem.

FIRST YEAR MODULES – SEMESTER 2:

MAT 1243 : Mathematics for Biological, Earth and Life Sciences II [credits 8]
Sample Space and Events, Probability, Counting methods, Probability and genetics, binomial and normal distribution, 1st and 2nd order equations, Oscillatory solutions, Systems of Difference equations applied to 1st and 2nd order Equations. Vectors in two dimensions, the inner product, Relative velocities, Matrices and their application

MAT 1245 : Business Mathematics II [credits 12]
Pre-requisites : MAT 1145
The gradient of a function and rates of change, Differentiation, Optimization, Curve sketching, Partial derivatives, optimization of functions of two variables. Application of differential calculus in economics: Demand and supply functions, elasticity, total revenue, marginal revenue and price elasticity. Introduction to Integral calculus: Area under a curve, the indefinite integral, and properties of definite integrals, techniques of integration.

STA 1248 : Basic Statistical Inference (Business, Economics and the Social Sciences) [credits 12]
Pre-requisites : STA 1148
Confidence intervals, Hypothesis testing with one sample and with two samples: means and proportions, Tests of independence and goodness of fit. Comparing of variance. ANOVA: comparing of several means.

STA 1249 : Basic Statistical Inference (for the Natural and Applied Sciences) [credits 8]
Pre-requisites : STA1149
Confidence intervals, Hypothesis testing with one sample and with two samples: means and proportions, Tests of independence and goodness of fit. Comparing of variance. ANOVA: comparing of several means.

SECOND YEAR MODULES – SEMESTER 2:

MAT 2249 : Quantitative Methods in Planning [credits 12]
Pre-requisites : MAT 1249
Review of probability and descriptive Statistics. Types and sources of basic planning data. Forecasting models in planning: continuous functions applied to planning forecast, population projection techniques. Cohort survival and other techniques, gravity and migration models. Practical uses and application of Spreadsheets and Statistical packages; Tests of significance for multiple samples using nominal, original and ratio scale samples.

THIRD YEAR MODULES – SEMESTER 2:

STA 3248 : Biometry [credits 12]
Pre-requisites : STA 1248 or STA 1249
Biometrical Analysis of Agricultural Experiments, Statistical tests of hypotheses, Correlation and regression, ANOVA.

STA 3249 : **Fundamentals of Agronomic Experimentation [credits 12]**
Pre-requisites : STA 1249 or STA 1248
Principles of field experimentation, Analysis of different experimental designs: completely randomized, randomized block designs, and Latin squares. Factorial Designs, missing plots.

FIRST YEAR MODULES – SEMESTER 1 OR 2:

COM 0110/COM 0210 : **Computer Literacy [credits 4]**
Introduction to Computers, Types of Computers, Hardware Components, Data Representation, Computer Arithmetic, Operating Systems, Applications Software, Computer Networks, Internet, Emailing, MS Windows, MS Word, MS Excel, MS PowerPoint, MS Access.

MAT 0143/0243 : Basic Service Mathematics [credits 12]
Arithmetic operations, Ratio and proportion, Percentages, Simple interest, Averages, Basic Algebra, Factorization, Indices and Logarithms, Angles and straight lines, triangles, Geometrical constructions, Simple equations, Formulae, Simultaneous equations, Quadratic equations, Areas and Volumes, Graphs, Variations, Quadrilaterals and Polygons, The circle, Loci, trigonometry and Scale drawing

MAT 0144/0244 : Service Mathematics [credits 12]
Differential Calculus, Integration, Proof of Theorems, The sine and cosine rules, Solid Geometry, Triangles of Velocities, The sphere, Latitude and Longitude, Sets, Matrices, Arithmetic and Geometric series and the Remainder Theorem

(b) MAINSTREAM MODULES:

FIRST YEAR MODULES – SEMESTER 1:

COM 1122 : Introduction to Computer Systems [credits 8]
History of computers, Basic computer architecture, Operating systems, Computer languages, Networks, The world-wide web and Writing reports and presentations

COM 1124 : Fundamentals of Computer Architecture [credits 8]
Digital systems, Signed integer representations, the basic instruction set, accessing memory, Input/Output, Floating point: IEEE 488 Standard coprocessors and Overview of RISC architecture

MAT 1141 : Differential Calculus [credits 8]
Introductory concepts: Functions, real numbers, definition of a function, graphs of elementary functions, limits, continuity; Differentiation of functions: derivatives, differentials, mean-value theorems for derivatives, Taylor's formula, L'Hospital's rule, curve sketching, differential of an arc, curvature.

MAT 1142 : Mathematics Foundation I [credits 8]
Elements of Sets and Logic. Real Number System and Inequalities. Complex Numbers, De Moivre's Theorem and Roots of Complex Numbers. Polynomials, Real and Complex Roots of Polynomials. Composite Functions and Inverse Functions. Trigonometric Functions and their Inverses. Euclidean Algorithm. Modular Arithmetic. Mathematical Induction. Permutations and Combinations. The Binomial Theorem

STA 1141 : Introduction to Statistics [credits 8]
Pre-requisites : MAT 0144/MAT 0244 (Service Mathematics)
Measurement scales. Descriptive Statistics: Measures of location and spread. Graphical presentation. Shapes of distributions. Populations and samples. The Central limit theorem and its application. Sampling distribution of a Statistic – the *t*, *F* and *Chi-Square* distributions.

STA 1142 : Introductory Probability [credits 8]
Pre-requisites : MAT 0144/MAT 0244 (Service Mathematics)
Co-requisites : STA 1141
Mathematical counting techniques. Probability and relative frequency, properties, addition rule, mutually exclusive events. Conditional probability, Baye's Theorem and independence. Random variables and probability distributions. Sample spaces and assignment of probabilities to events. Special discrete probability distributions and the normal distribution.

FIRST YEAR MODULES – SEMESTER 2:

COM 1226 : Computer Technology [credits 8]
Pre-requisites : COM 1124
Co-requisites : MAT 1141, MAT 1242
Simple DC circuit analysis, CMOS VLSI MOS transistors, CMOS gates, The VLSI process, designing a simple CMOS processor chip, Performance, System design, Component-based, system-on-chip, (SoC), CPU/RAM/ ROM/peripherals, Address decoding, On-chip buses, Interrupts, DMA Interfaces: Digital Signal Processing, Pipelining, Monitors, Video Standards, storage devices, LANs, Serial lines, Keyboards and mice, Printers Interface Standards.

MAT 1241 : Integral Calculus [credits 8]
Pre-requisites : MAT 1141
Indefinite Integrals: antiderivative, indefinite integral, basic integration methods, techniques of integration, trigonometric and hyperbolic functions, transcendental functions. Definite integrals: definite integral, the limit of a sum, geometrical and physical meaning, improper integrals, basic properties, mean-value theorem for integrals, geometrical applications- areas, arc lengths, volumes, area of a surface, other applications-moments, centres of gravity; work of a variable force

MAT 1242 : Mathematics Foundation II [credits 8]
Pre-requisites : MAT 1142
The Straight Line, Introduction of Conic Sections, Parabolas, Ellipses, Hyperbolas, Rotation of Axes, Polar Coordinates and parametric Equations. Matrices and Determinants. Rank of a Matrix. System of Linear Equation, Crammer's Rule and Gaussian Elimination method. Vectors and Scalars. The Dot and Cross Product. Planes in 3D-space.

MAT 1246 : Mechanics I [credits 8]
Pre-requisites : PHY 1121
Vector calculus, vector product, scalar product, divergence, grad, curl, curvilinear coordinate systems. Conservation of energy and momentum, elastic and inelastic collisions, simple systems of particles. Projectile motions, variable mass motion, rigid body motion.

MAT 1247 : Numerical Analysis I [credits 8]
Pre-requisites : MAT 1141
Approximating a number: numerical errors and computer arithmetic. Solution of nonlinear equations in one variable: isolation of roots, graphical methods, bisection method, method of chords, Newton-Raphson method, fixed point method, evaluation or errors for various methods. Taylor series expansions, finite difference of derivatives, Computer problems.

STA 1241 : Elementary Statistical Methods I – Introductory Inference [credits 8]
Pre-requisites : STA 1141, STA 1142
Confidence Intervals for the mean and variance of a normal distribution; Confidence Intervals for means and proportions with large samples; Testing hypotheses about the mean and variance of a normal distribution; Testing Hypotheses about means and proportions with large samples. Comparing several means - Analysis of Variance

STA 1242 : Elementary Statistical Methods II – Correlation and Regression [credits 8]
Pre-requisites : STA 1141, STA 1142
The simple linear regression model. Estimation of the parameters of the simple linear regression model. Hypothesis testing in simple linear regression. Pearson's product-moment and Spearman's rank correlation coefficients; Testing

hypothesis about the correlation coefficient. Relation between regression and correlation. Analysis of contingency tables – the chi-square test. Case Studies

FIRST YEAR MODULES – YEAR LONG MODULES:

COM 1321 : Object Oriented Programming [credits 16]
Introduction to programming, Software development and objects, Programming basics, Numerical data and encoding, Processing input, Defining instantiable classes, Selection Statements, Repetition Statements, Characters and strings and Arrays.

SECOND YEAR MODULES – SEMESTER 1:

COM 2120 : Digital Design Techniques [credits 10]
Pre-requisites : COM 1124
System specification, Top-level behavioural description, Architectural design, Register Transfer Level design, Hardware description languages, Testability, Timing and clocking, Logic design and Logic to layout.

COM 2123 : Imperative Programming [credits 10]
Pre-requisites : COM 1321
Basics, Aggregate types, Pointers and memory management, Examples of dynamic data structures: linked lists, trees, Function pointers and callbacks, I/O in C, Esoteric features, Basic C++, Inheritance and virtual functions, Templates and the STL.

COM 2125 : Operating Systems [credits 10]
Pre-requisites : COM 1122, COM 1124
Processes, Memory Systems, File Systems, Case studies: Windows 2000/XP, Unix, Linux.

COM 2126 : Human-Computer Interaction [credits 10]
Pre-requisites : COM 1122 or COM 1321
User-centred design of human-computer interaction, Social security and safety aspects of computing and of using computers, Interaction devices, Principles of design for understandability and usability, Design and evaluation of interactive systems.

COM 2128 : Artificial Intelligence Fundamentals [credits 10]
Pre-requisites : COM 1321
Introduction to AI, Introduction to frames and rules, Knowledge representation, logic and language, Problem solving and search, Uncertainty, probability, Bayes' Rule, and belief nets, Introduction to planning, Knowledge-based systems, agents, time, space, and ontologies and Learning.

COM 2129 : Database Fundamentals [credits 10]
Pre-requisites : COM 1321, COM 1124
Fundamental database concepts, Relational database model and normalization, Entity-relationship modelling, Transaction management and concurrency control, Distributed database management systems, Object-oriented databases, Client/server systems, Data warehousing, Databases in electronic commerce.

MAT 2141 : Linear Algebra [credits 10]
Pre-requisites : MAT 1242
Vector spaces and subspaces, Linear Dependences, Basis and Dimensions, Linear Transformations, Eigenvalues and Eigenvectors, Inner Product Spaces and Cauchy Schwartz Inequality, Applications.

MAT 2142 : Multivariable Calculus [credits 10]
Pre-requisites : MAT 1241
Functions of several variables: introductory concepts, continuity and partial derivatives, directional derivatives, higher order derivatives and differentials, tangent plane, normal to a surface, Taylor's formula, extremum, space curves, Multiple and line integrals: double and triple integrals, and geometrical and physical applications , improper integrals dependent on a parameter and improper multiple integrals, line and surface integrals

MAT 2148 : Mathematical Modelling I [credits 10]
Pre-requisites : MAT 1241 or MAT 1246
Introductory concepts, descriptions of problems that can be investigated and indication of relevant mathematical topics, mathematical modelling of the problems, Models on real-world systems, Models that involve the concept of proportionality, derivatives, integrals, matrices, linear systems of equations, Simplifying of the model as required,

Examples from different fields of applications. Solving some of these models through graphical and other methods already learnt.

STA 2141 : Probability Distributions [credits 10]
Pre-requisites : STA 1142, MAT 1141, MAT 1241
Co-requisite : MAT 2141
Random variables. Probability density functions and cumulative distribution functions. Special discrete probability distributions; special continuous probability distributions. Characteristic functions and their properties. Covariance and correlation. Joint, marginal and conditional distributions. Expectation and variance. Moments and moment generating functions. Functions of random variables and their properties. Limit Theorems.

STA 2142 : Multiple Regression [credits 10]
Pre-requisites : STA 1241, STA 1242, MAT 1242
Co-requisite : MAT 2141
Multiple regression models. Estimation of parameters. Inference about regression parameters and mean response; Extra sums of squares. Prediction intervals. Residual analysis. Multi-collinearity and its effects. Diagnostics and remedial measures. Model building – stepwise procedures. Case Studies

SECOND YEAR MODULES – SEMESTER 2:

COM 2216 : Reasoning About Programs [credits 10]
Pre-requisites : MAT 1141, MAT 1142
Co-requisites : COM 1321
Introduction to universes, First-order logic, Pre-post-condition specifications, Commands as predicate transformers, Weakest pre-conditions, Path functions, Verification conditions, and testing *vs* proving.

COM 2224 : Algorithms and Data Structures [credits 10]
Pre-requisites : COM 1321
Co-requisites : COM 2123
Objects and classes, Inheritance, Algorithm, analysis, Abstract data types, Lists, stacks and queues, Recursion, Sorting algorithms, Trees and binary search trees, Graphs and paths, and Complexity analysis.

COM 2226 : Data Communication and Computer Networks [credits 10]
Pre-requisites : COM 1122, COM 1124, COM 1321, MAT 1141, MAT 1142
Communication and network architectures, The OSI and TCP/IP models, Data-link protocols, HDLC, PPP, Media Access Control (MAC) protocols, Network technologies, Internetworking issues, Internetworking facilities, switches, bridges, routers, and gateways, Routing protocols, Transport , Application, Application protocols.

COM 2228 : Contemporary Object-Oriented Concepts [credits 10]
Pre-requisites : COM 1321
Co-requisites : COM 2229
Basic object-oriented concepts, Models for the object-oriented approach, Simple object-oriented requirements models, Generalization/specialization and whole-part hierarchies, Object-oriented SDLCs, Object-oriented design, Object-oriented development.

COM 2229 : Systems Analysis [credits 10]
Pre-requisites : COM 1122 or COM 1124 or COM 1321
Co-requisites : COM 2129
Psychological and behavioral aspects, decision models, the value of information, IS in organizations: Organization models, types of organizational information systems, DSS, distributed processing, information systems planning, Players in the systems game, system building blocks, Information system development, systems analysis, Requirements discovery, Data modelling and analysis, Process modeling, Feasibility and the system proposal.

MAT 2241 : Real Analysis I [credits 10]
Pre-requisites : MAT 1142
The Real Number System: Algebraic property, Order Property and Completeness property. Sequences of real numbers: limits, convergence, divergence, limsup, liminf, subsequences, Cauchy sequences. Series: infinite series, series tests, power series. Topology of the real line: open sets, limits, closed sets, bounded sets, compact sets, Bolzano-Weistrass theorem, Heine Borel Theorem, Functions: injective, surjective, inverses, compositions, limits of functions, continuity, Fixed Point Theorem. Differentiation in $\Re$ **:** Riemann sums, Reimann-Stiltjies integration

MAT 2242 : Ordinary Differential Equations I [credits 10]
Pre-requisites : MAT 1241
Introductory concepts: - basic definitions, families of curves, initial/boundary conditions, existence and uniqueness of solutions, models. Techniques of solving First Order Differential Equations:- separable variables, homogeneous equations, exact equations, linear equations and the integrating factor, the equations of Bernoulli, Ricatti and Clairaut. Applications: - orthogonal trajectories, growth and decay, cooling, circuits and mixtures. Higher Order Differential equations with constant coefficients:-independence of solutions, the Wronskian, the superposition principle, characteristic equations, undetermined

MAT 2247 : Numerical Analysis II [credits 10]
Pre-requisites : MAT 1247
Direct and indirect methods for approximating solutions of linear systems: Gaussian elimination with pivoting and scaled partial pivoting, LU-decomposition, error analysis. Iterative schemes-Jacob scheme, Gauss-Siedel method, convergence of iterative schemes. Linear programming: introductory examples, graphical solution, simplex method, general linear programs, coordinate shift method, 2-phase method, discrete Chebyshev method. Numerical differentiation and integration: approximating the derivative, error analysis, trapezoidal and Simpson' rules, interpolatory and Gaussian quadratures. Using computer programming and packages.

MAT 2248 : Vector Analysis [credits 10]
Pre-requisites : MAT 2142
Introductory concepts: scalar and vector algebra. Vector function of a scalar argument, differential geometry of curves; Scalar and vector fields; Line, surface and volume integrals, integral theorems; Potential fields; Curvilinear coordinates; Cartesian tensor

STA 2241 : Statistical Computing [credits 10]
Pre-requisites : STA 1142, MAT 1141, MAT 1241
This course is about acquiring the fundamental computing skills necessary for effective careers as statisticians and data analysts. Computation data analysis is an essential part of modern statistical sciences. Competent statisticians must not just be able to run existing programs, but to understand the principles on which they work. They must also be able to read, modify and write code, so that they can assemble the computational tools needed to solve their data-analysis problems, rather than customizing problems to fit tools provided by others. At the heart of this course, students will learn the core of ideas of programming functions, objectives, data structures, flow control, input and output, debugging, logical design and abstraction. In the content of Statistics and data analysis through writing code to assist in numeric and graphical statistical analyses. Students will in particular learn how to write maintainable code, and to test code for correctness. A language of currency, e.g. R, SAS, Stata, should be used for this course and emphasis should be on hands on skills acquisition.

STA 2242 : Sampling Techniques [credits 10]
Pre-requisites : STA 1241, STA 1242
The need for sampling. Carrying out a sample survey. Probability and non-probability sampling. Simple random Sampling. Estimation. Sampling from stratified populations. Cluster and multistage sampling. Case studies.

SECOND YEAR MODULES – YEAR LONG MODULES:

COM 2301 : Computer Science Laboratory [credits 10]
Pre-requisites : COM 1321
Co-requisites : COM 2123, COM 2224
The module provides essential practical work associated with taught course modules. The laboratory exercises undertaken depend on the choice of modules. The topics covered in each module laboratory are described in the separate module syllabi.

THIRD YEAR MODULES – SEMESTER 1:

Students are not allowed to proceed to do third year modules before clearing all first-year modules.

COM 3120 : Software Engineering I [credits 14]
Pre-requisites : COM 1321
Scope of software engineering, the software process, software life cycle models, teams, tools of the trade, testing, planning, estimating, Object Oriented Software Development using UML, System Specification using Z, Requirements Analysis, User Interface Evaluation.

COM 3121 : Distributed Operating Systems [credits 14]
Pre-requisites : COM 2125
Operating system structures, Distributed systems, Resource management, Protection and security, Distributed file

systems, Example distributed systems.

COM 3128 : Systems Design and Implementation [credits 14]
Pre-requisites : COM 2229
The structured lifecycle model, IS building blocks, Structured design methodology, design aids and phase products, Systems design and construction, Database design and prototyping, User interface design, Application system development methodologies, Systems implementation and support, Cost/benefit analysis

MAT 3141 : Real Analysis II [credits 14]
Pre-requisites : MAT 2241
Construction of the real number system: Dedekind cuts, Cantor Sets. Introduction to Metric space Topology in $\Re^n$ **:** neighborhoods, cluster points, open sets, Compact sets, bounded sets, connected sets, Cantor's intersection Theorem, Bolzano-Weierastrass theorem, Heiene-Borel Theorem, Lebesque Covering Theorem. Functions in $\Re^n$ **:** Limits of functions, Continuity, Globe continuity, bounded continuous functions, Continuity of the inverses, Lipschitz condition and contraction, continuity and compactness, continuity and connectedness, Brauwer's Fixed point Theorem, Contraction of fixed points. Sequences in $\Re^n$: Limits, convergence, divergence, subsequences. Sequence of functions: Uniform convergence, Cauchy's Criterion. Differentiation in $\Re^n$ **.**

MAT 3142 : Group Theory [credits 14]
Pre-requisites : MAT 2141
Groups and Subgroups, Cyclic groups. Groups of permutations and Cayley Theorem. Normal Subgroups, cosets and Quotient Groups. Direct Products and the Fundamental theorem of Finite Abelian Groups. Homomorphism and Isomorphism Theorems for Groups.

MAT 3146 : Finance Mathematics [credits 14]
Pre-requisites : MAT 2156, STA 2241
A simple market model: basic notions and assumptions. No-arbitrage principle. One-step Binomial model. Risk and return. Options and replication. Risk-free and risky assets: Simple interest, periodic and continuous compounding. Dynamics of stock prices. Expected return. Binomial and trinomial tree model. Martingale property. Discrete time market models: basic notions of a portfolio, self-financing, and predictability. Principle of arbitrage with its applications.

MAT 3147 : Partial Differential Equations [credits 14]
Pre-requisites : MAT 2242
Introduction: what are PDEs? Classification, PDES with associated conditions as mathematical models. First Order Equations: quasilinear equations, method of characteristics, existence and uniqueness theorem, conservation laws, nonlinear equations. Second Order Equations in 2D: classification, canonical form of hyperbolic, parabolic and elliptic equations. Heat equation: method of separation of variables. One-dimensional Wave Equation: general solution, Cauchy problem

MAT 3149 : Ordinary Differential Equations II [credits 14]
Pre-requisites : MAT 2242
Differential equations with variable coefficients: - Cauchy-Euler equations, power series solutions, Bessel's equation, Legendre's equation. Laplace Transformation: – Laplace transforms and inverse transforms, translation theorems, solution of a differential equation. Linear systems of differential equations: – solutions using eigenvectors and eigenvalues, matrix exponential, stability of the systems. Nonlinear systems and stability: – introductory concepts, stability of the systems, conservative systems, phase plane methods.

MAT 3156 : Statistical Finance Mathematics [credits 14]
Pre-requisites : MAT 2156
Review on probability theory. Probabilities and events. Conditional probability. Random variables and expected values. Optimization models: A review on optimization theory. A deterministic optimization model. Probabilistic optimization problems with financial applications. Valuing by expected utility: Valuing investments by expected utility. The portfolio selection problem.

STA 3141 : Statistical Inference [credits 14]
Pre-requisites : STA 2141
Sampling distributions. Point and interval estimation. Optimal properties of estimators. Methods of estimating parameters. UMP tests and Neyman-Pearson lemma. Likelihood ratio tests. *p*-values and errors. Tests of hypotheses about means, variances, proportions, difference between means, ratio of variances.

STA 3142 : Industrial Statistics [credits 14]
Pre-requisites : STA 2141
Quality Improvement in the Modern Business Environment. Modeling Process Quality. Inferences about Process Quality. Methods and Philosophy of Statistical Process Control (SPC). Control Charts for Variables.

STA 3143 : Introduction to Research and Official Statistics [credits 14]
Pre-requisites : STA 1241, STA 1242
Rationale for research. Research design. Sources of data. Sampling procedures. Demographical population parameters. Basic projections of population parameters. Use of Statistical packages.

THIRD YEAR MODULES – SEMESTER 2:

Students are not allowed to proceed to do third year modules before clearing all first-year modules.

COM 3217 : Professional Issues in Computing and Information Technology [credits 14]
Pre-requisites : COM 3120
Problems of ethical decision-making, Professionals, professional societies and their codes of conduct and practice, Case studies: Describing steps to resolve the current situation, Preparing policies and strategies, Graduate careers in the 21st century, Building the foundations to future career success, The law and contracts, Safety-critical systems and legal liability, A business view of contracts, Computer misuse and the law in South Africa, UK, and the USA, Health and safety issues.

COM 3220 : Software Engineering II [credits 14]
Pre-requisites : COM 3120
Introduction, Notations for design, Challenges and pitfalls of software design, Interaction models of humans and computers, Ergonomics, Interaction styles, Screen design and layouts, Architecture, Code construction, Configuration management, Quality assurance, Testing, Metrics, Software engineering in the real world.

COM 3221 : Advanced Algorithms [credits 14]
Pre-requisites : COM 2224
Complexity classes and NP-completeness, Machine model, Undecidability, Complexity classes and their relations, Reduction and completeness, Structure of the polynomial hierarchy, NP-complete problems, Graphs, trees and geometry, DFS, BFS and other search methods, Algorithms based on search techniques, Trees and acyclic digraphs.

COM 3224 : Architectural Support for Languages and Operating Systems [credits 12]
Pre-requisites : COM 2123, COM 2125
Architectural support for high-level languages: Instruction sets, Stacks, CISC versus RISC architectures, Scalar arithmetic, Data structures, Control constructs, Runtime Stack. Architectural support for operating systems: Address translation, Caching, Support for higher computational performance.

COM 3226 : Artificial Intelligence [credits 14]
Pre-requisites : MAT 1141, MAT 1242
The following are covered; Bayesian decision and classification, Introduction to learning theory and model evaluation, Neural networks, Learning from non-numerical data, Non-symbolic search techniques, Reinforcement Learning.

COM 3227 : Evaluation of Information Systems [credits 14]
Pre-requisites : COM 3120
The module emphasizes the essential role information system play in today's successful businesses and covers; Evaluation of business processes, Evaluation of IS investment, Evaluation of IS processes and products.

COM 3229 : Database design and implementation [credits 14]
Pre-requisites : COM 2129
The module develops practical skills in database implementation and manipulation and covers; Using commercial relational database management software, Implementing database designs, Using SQL (Structured Query Language) to build application programs, Database administration and management, Executing and managing database transactions and concurrency control by means of SQL

MAT 3241 : Complex Analysis [credits 14]
Pre-requisites : MAT 2241
Functions of complex variable. Complex valued functions. Analytic functions. Complex differentiation. Complex integration. Transformations. Power series of complex valued functions: Taylor series, Maclaurian series, and Laurent series. Singularities, poles, and residues of complex valued function.

MAT 3242 : Rings and Fields [credits 14]
Pre-requisites : MAT 3142
Basic properties of Rings and fields. Divisors of Zero. Integral Domains. Ideals and Quotient Rings. Maximal and Prime Ideals. Rings of Polynomial. Unique factorization Domains and Euclidean Domains.

MAT 3243 : Graph Theory [credits 14]
Pre-requisites : MAT 3142
Introductory concepts, Sub graphs, Complements, Graph Isomorphism, Vertex degree, Eulerian Graphs, Euler's Formula, Multigraphs and Euler's circuits, Connectivity, Hamilton Graphs, Chromatic number, Trees and their applications

MAT 3244 : Continuum Mechanics [credits 14]
Pre-requisites : MAT 1246 or PHY 2121, MAT 3147
Continuous material system, Algebra and calculus of Cartesian tensors, Stress and strain tensors. Generalized equations of motion. Introduction to theory of elasticity and plasticity with applications

MAT 3246 : Mechanics II [credits 14]
Pre-requisites : MAT 1246, MAT 3147
Dynamics and Statistics of a particle, moving coordinate systems, systems of particles and rigid bodies, Lagrange's equations and Hamiltonian theory

MAT 3247 : Numerical Analysis III [credits 14]
Pre-requisites : MAT 2247
Polynomial Interpolation. Approximation of Functions. Matrix eigenvalue problem. Power method, Schur's and Gershgorin's theorems. QR-algorithm for eigenvalue problem. Computer programming and packages

MAT 3248 : Mathematical Modelling II [credits 14]
Pre-requisites(s) : MAT 2148, MAT 2242
Differential equations used as mathematical models, qualitative analysis of differential equations with phase portraits, application to population growth, economics, finance, ecological models, and mechanics.

MAT 3249 : Geometry [credits 14]
Pre-requisites : MAT 2142, MAT 2242
Topics in projective planes, Euclidean and non-Euclidean Geometry

MAT 3256 : Advanced Financial Mathematics [credits 14]
Pre-requisites : MAT 3146
Portfolio management: Risk and expected return on portfolio with two securities and several securities. Options: General properties. Option pricing and applications. Financial modelling: Computer applications.

STA 3241 : Time Series Analysis [credits 14]
Pre-requisites : STA 2141
Introduction to the Classical Approach to Time Series Analysis. The decomposition of a time series. Trend analysis. Smoothing methods. Analysis of seasonal effects. Forecasting. Case Studies.

STA 3242 : Experimental Design [credits 14]
Pre-requisites : STA 1241, STA 2141
Principles of ANOVA. Completely randomized designs. Randomized block designs. Analysis of covariance. Two-way experimental layouts. Other Factorial Designs. Latin Squares. Response surfaces. Case Studies

STA 3243 : Multivariate Methods [credits 14]
Pre-requisites : STA 2141, MAT 2247
Multivariate distributions. Sampling from the multivariate normal distribution. Transformations to near normality. Inferences about the mean vector. Comparison of several multivariate means.

8.3 BACHELOR OF SCIENCE HONOURS DEGREE [BSc. Hons] OFFERED BY THE DAPRTMENT OF MATHEMATICAL AND COMPUTATIONAL SCIENCES

8.3.1. ADMISSION REQUIREMENTS

Qualification	Qualification Code	Duration	Admission Requirements
BSc Hons (Applied Mathematics)	MNHHAM	1 year	• A candidate will be allowed to register for the Honours degree only if he/she possesses a BSc degree or equivalent or subject to SENATE approval, if he/she has completed the modules for a BSc degree, or if equivalent status has been conferred on him/her by SENATE. • Candidates must have passed the final-year modules of the subject in which they wish to study with an aggregate of 60%. Candidates with lower level passes may be accepted subject to SENATE approval. • Prospective candidate could be subjected to a final selection test which serves to assess their preparedness for the Honours course.
BSc Hons (Mathematics)	MNHSHM	1 year	• A candidate will be allowed to register for the Honours degree only if he/she possesses a BSc degree or equivalent or subject to SENATE approval, if he/she has completed the modules for a BSc degree, or if equivalent status has been conferred on him/her by SENATE. • Candidates must have passed the final-year modules of the subject in which they wish to study with an aggregate of 60%. Candidates with lower level passes may be accepted subject to SENATE approval. • Prospective candidate could be subjected to a final selection test which serves to assess their preparedness for the Honours course.
BSc Hons (Computer Science)	MNHHCS	1 year	• A candidate will be allowed to register for the Honours degree only if he/she possesses a BSc degree or equivalent or subject to SENATE approval, if he/she has completed the modules for a BSc degree, or if equivalent status has been conferred on him/her by SENATE. • Candidates must have passed the final-year modules of the subject in which they wish to study with an aggregate of 60%. Candidates with lower level passes may be accepted subject to SENATE approval. • Prospective candidate could be subjected to a final selection test which serves to assess their preparedness for the Honours course.
BSc Hons (Statistics)	MNHSHS	1 year	• A candidate will be allowed to register for the Honours degree only if he/she possesses a BSc degree or equivalent or subject to SENATE approval, if he/she has completed the modules for a BSc degree, or if equivalent status has been conferred on him/her by SENATE. • Candidates must have passed the final-year modules of the subject in which they wish to study with an aggregate of 60%. Candidates with lower level passes may be accepted subject to SENATE approval. • Prospective candidate could be subjected to a final selection test which serves to assess their preparedness for the Honours course.

8.3.2. RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture. (b) The honours degree is offered over ONE academic year and students write examinations and present themselves for continuous assessment during the year of registration. (c) **Project reports must be handed in before the 30th November of the academic year to graduate in the following May graduation.** (d) Except with the special permission of SENATE, the duration of the full-time study **will not exceed TWO years** (e) The degree will not be conferred on a candidate before at least one year has elapsed since he/she obtained the Bachelor's degree or another undergraduate degree as set out in the Faculty rules and unless he/she has been registered for one year at this University.
ASSESSMENT CRITERIA	(a) Candidates will only be assessed in a specific module if they attended lectures, tutorials and prescribed practical satisfactorily and obtained a semester mark of at least 50%. (b) A student **must** attain a minimum of 50% pass in **each** of the components of assessment. A student, who fails one of these components, will be allowed to repeat only that component. The written examination component will be conducted during the next normal examination period for that specific module. (c) All written examinations will be taken only during official examination sessions**.** (d) A candidate who fails two modules in the degree and obtains an aggregate of at least 50% may be admitted for assessment in those modules on one further sitting. (e) To obtain the degree cum laude, a candidate must attain an aggregate of 75% or higher. (f) To be awarded the BSc Hons degree, the candidate must accumulate at least 120 credits at this level. (g) Special examinations **will not be offered** in the BSc Hons degree. (h) An Aegrotat Examination may be granted to a student who has been prevented from sitting for the examination: • By illness on the day of the examination or assessment, or immediately before the examination or assessment, if a medical certificate from a registered medical practitioner is submitted to the Faculty, and/or if the student's application is supported by the invigilator concerned or another responsible person; or • Because of domestic circumstances such as serious illness or death of a close relative during the examination or assessment, or other reasons, if the Faculty judges it to be a bona fide case, and the student can provide satisfactory proof of such extraordinary circumstances.

8.3.3 BSc HONS: QUALIFICATIONS AND MODULE DESCRIPTIONS

BSc HONS (COMPUTER SCIENCE) **[CODE: MNHHCS]**

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
COM 5131 [credits 10]: Introduction to Grid Computing	**COM 5231 [credits 10]: Introduction to Wireless and Ad hoc Networking**
COM 5132 [credits 10]: Software Engineering Methodology	**COM 5232 [credits 10]: Forensic Computing**
COM 5133 [credits 10]: Information Systems Security	**COM 5233 [credits 10]: Compiler Principles**
COM 5134 [credits 10]: Scientific Research Method	**COM 5234 [credits 10]: Guided Reading II**
COM 5135 [credits 10]: Guided Reading I	
COMPULSORY YEAR MODULES	
COM 5300 [credits 30]: Honours Research Project	
Total Credits only = 120	

COM 5131 [credits 10]: Introduction to Grid Computing
Fundamentals of Service Oriented Architecture (SOA) and Grid. Benefits of Grid Computing. Terms and Terminology, Types of Grid. Grid Architecture, Overview of Grid Standards (OGSA, OGSA-DAI, GridFTP, WSRF, OGSI, etc). Security in Grid, Grid Topology, Practical Issues in Resource Allocation, deployment and Optimization in Grid. Creating Grid Environment with Globus Toolkit 4.

COM 5132 [credits 10]: Software Engineering Methodology
Software Specification Styles and Methods, Software Engineering for Mobile Commerce (analysis, design, wireless intranet Stack etc). Component-Based Development. Web Services architecture, management and development .Architectural Design of Product lines. Change Control, Software Evolution and their relationship to Configuration Management. Necessity of Change as a fact of life for Software Systems. Evolution of Legacy Systems and Re-use. Impact Analysis and Refactoring in Software. Tools for Software Comprehension and Maintenance.

COM 5133 [credits 10]: Information Systems Security
Access Control Mechanisms, Application Security towards software application development, Business Continuity and Disaster Recovery Planning, Cryptography- Confidentiality, integrity, authorization and authentication, Information Security and Risk Management, Legal, Regulations, Compliances and Investigations, Operations Security, Physical (Environmental) Security, Security Architecture and Design

COM 5134 [credits 10]: Scientific Research Method
Introduction to Research Methods; Criteria for good scientific practice, Literature Review, Critical Use of existing knowledge, Generalize and define limits of new findings, Scientific Publishing. Classification of Conferences and Journals, Judging what material is publishable, publishing, Referee Process, Theory of Science: Theory of Science and Computational Science, viz Innovation, Systemizing and Classifying, Hypothesis development and testing, Establishing laws and Models, Criticizing own and others work. Ethics: Computer Ethics in Research. Ethics and Plagiarism. Development of Research Plan

COM 5135 [credits 10]: Guided Reading
For modules whose title is "**Guided Reading"**, the contents would be variable and would reflect current professional issues in Computer Science. This is because there is a rapid evolution in the field of computer science and this requirement reflects the new framework for Honours programme in Computer Science

COM 5231 [credits 10]: Introduction to Wireless and Ad hoc Networking
Basics of Networking and Protocols, Network Standards and the OSI Network layered model, Transmission Basics and Media, Network Layer protocols and Network Routing, Topologies and Access Methods, WANs, Internet Access and Remote Connectivity, Internet and TCP/IP Protocols, Socket Programming basics, Multimedia Communications and QoS Basics, Troubleshooting Network Problems: Error detection and Correction

COM 5232 [credits 10]: Forensic Computing
Understanding the computer crime and the people on the scene; Modus Operandi; Motive and Technology, Nature of digital evidence and its value to forensic investigation. Collection and preservation of digital evidence; forensic analysis of different operating systems and Networks. Using digital evidence in an investigation. Building the computer crime case; legal issue in an investigation. Stream and Block Ciphers, Public Key Encryption, Hash functions and Data Integrity. Identification of Entry Authentication. Digital Signatures. Key Management Techniques.

COM 5233 [credits 10]: Compiler Principles
Introduction to Compilation. General structure of a Compiler. Overview of compilation technology. Phases of Compilation – Lexical, Syntax and Semantic Analysis, Regular Expressions, Finite-State Machines – DFA and NFA. Type Checking, Intermediate Code generations and Scanner generator tools, Grammars and Languages, Tokens, Lexeme

COM 5234 [credits 10]: Guided Reading
For modules whose title is "**Guided Reading"**, the contents would be variable and would reflect current professional issues in Computer Science. This is because there is a rapid evolution in the field of computer science and this requirement reflects the new framework for the BSc Honours programme in Computer Science

COM 5300 [credits 30]: Honors Research Project
Students would be expected to carry out a research project on a topic of their choice within the computing field. A qualified member of Staff will offer guidance in the carrying out of the research. Assessment of the project shall be done by both the supervisor and an external examiner.

BSc HONS (APPLIED MATHEMATICS) [CODE: MNHHAM]

Students are advised to seek for guidance from the Head of the Department in the matters concerning the programmes to be followed and pre-requisites, other than just a BSc degree with Mathematics or Applied Mathematics as a major, for certain modules. For example: a student who wishes to follow the Applied Mathematics degree would require certain modules, like MAT 3247, which are electives in some undergraduate programmes.

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
MAT 5130 [credits 15]: Numerical Solution of ODEs	**MAT 5230 [credits 15]: Numerical Solution for Partial Differential Equations**
MAT 5149 [credits 15]: Partial differential Equations	
Candidate must select any THREE (3) of the following modules:	
MAT 5132 [credits 15]: Functional Analysis	**MAT 5233 [credits 15]: Integral Equations**
MAT 5133 [credits 15]: Calculus of Variations	**MAT 5241 [credits 15]: Financial Mathematics**
MAT 5137 [credits 15]: Measure and Integration Theory	**MAT 5243 [credits 15]: Graph Theory**
MAT 5140 [credits 15]: Matrix analysis	**MAT 5246 [credits 15]: Topics in stability and Optimization**
MAT 5141 [credits 15]: Stochastic Differential equations I	**MAT 5253 [credits 15]: Control Theory**
MAT 5143 [credits 15]: Fluid mechanics	**STA 5244 [credits 18]: Stochastic Processes**
STA 5141 [credits 18]: Probability Theory	
COMPULSORY YEAR MODULES	
MAT 5301 [credits 30]: Project	
Total Credits only = 120	

MAT 5130 [credits 15]: Numerical Solution of ODEs
Initial Value Problems for ODEs. Boundary Value Problems for ODEs.

MAT 5149 [credits 15]: Partial Differential Equations
Sturm-LioUnivenille Problems and eigenfunction expansion. Elliptic Equations: basic properties, maximum principle, Green's identities, separation of variables. Green's Functions and Integral Representations: Dirichlet problem, Neumann's function in the plane, heat kernel. Variational Methods: calculus of variations, function spaces and weak formulation.

MAT 5132 [credits 15]: Functional Analysis
Metric spaces, Banach spaces, Hilbert spaces. Fundamental theorems for normed and Banach spaces. Banach's Fixed Point Theorem. Approximation theorem. Spectral theory of linear operators in normed spaces. Spectral theory of bounded self – adjoint operators

MAT 5133 [credits 15]: Calculus of Variations
The fundamental problem of calculus of variation. Euler differential equation. Euler Poisson equation. Ostradisky problem. Brachistochrone equation. Trasversalty condition. Extrema conditions. Jacobi condition. Legendre condition. Weierstrass condition. Canonical forms. Direct methods. Ritz method. Kantorovich method. Applications.

MAT 5137 [credits 15]: Measure and Integration Theory
Set theory, rings, sigma-rings, fields, sigma-fields, Borel measure, measure, outer measure. Caratheodory, extension procedure for measures on a ring. Measurable functions. Lebesgue measure on a real line. Lebesgue integrals. Convergence Theorems. Fatou's Lemma and Fubini's theorem.

MAT 5140 [credits 15]: Matrix analysis
Eigenvalues, eigenvectors and similarity. Unitary equivalence and normal matrices. Canonial forms. Hermitian and symmetric matrices. Matrix norms. Location and perturbation of matrices. Positive definite Matrices

MAT 5141 [credits 15]: Stochastic Differential equations I
Preliminaries. Ito integrals. Ito processes and Ito formula. Stochastic Differential Equations

MAT 5143 [credits 15]: Fluid mechanics
Cartesian tensors, *Conservation* laws, Incompressible flow, properties of fluid flows, small disturbance theory, shallow water theory, Compressible flow. Shock waves

STA 5141 [credits 18]: Probability Theory
Probability spaces and random variables. Distribution functions. Mathematical expectation. Conditional distribution and Independence. Characteristic Functions. Convergence concepts: Weak convergence, convergence in probability, convergence concepts. Laws of Large numbers. Central Limits Theorems and applications.

MAT 5230 [credits 15]: Numerical Solution of Partial Differential Equations
Elliptic boundary value problems, finite differences; Parabolic initial boundary value problems, finite differences; hyperbolic Partial Differential Equations

MAT 5233 [credits 15]: Integral Equations
Integral equations of Fredholm's type. Fredholm's Theorems. Solvability. Systems of integral equations. Equations with degenerate kernels. Equations with symmetric kernels. The resolvent. Equations involving weak singularities. Singular equations. Equations of Volterra type. Integral equations of the first kind.

MAT 5241 [credits 15]: Financial Mathematics
Topics will be chosen from the following: Expectation pricing. Arbitrage pricing. Expectation vs. arbitrage. Discrete processes. Stochastic calculus. Ito calculus. Change of measure-the C-M-G theorem. Martingale representation theorem. Construction strategies. Blackl-Scholes model. Black-Scholes action. Pricing market securities. Interest rates. Bigger models.

MAT 5243 [credits 15]: Graph Theory
Structure of graphs, trees and connectivity, Eulerian and Hamilton graphs, planar graphs, graph embeddings, graph colorings and factorizations, subgraphs and degree sequence

MAT 5246 [credits 15]: Topics in stability and Optimization
Liapunov's Stability theory. Pontryagin's theorem.

MAT 5253 [credits 15]: Control Theory
Introduction to control theory: examples; continuous-time systems, discrete-time systems. Linear control systems; controllability, observability and polynomials; linear feedback, State observers, realization of constant systems, discrete-time systems. Optimal control; Performance indices. Variational methods. Potryagin's principle. Linear regulator.

STA 5244 [credits 18]: Stochastic Processes
Elements of stochastic processes, Markov chains, Recurrence, Limit theorems of Markov Chains, Renewal processes, Martingales, Brownian motion

MAT 5301 [credits 30]: Project
The research project shall be based on individual effort in the preparation of the research proposal and carrying out of the actual research with the assistance of a qualified member of Staff. The research shall be done on any topic of interest picked up from either pure mathematics or applied mathematics.

BSc HONS {MATHEMATICS) **[CODE: MNHSHM] - package 1**

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
MAT 5134 [credits 15]: Algebra I	**MAT 5232 [credits 15]: General Topology**
MAT 5137 [credits 15]: Measure and Integration Theory	**MAT 5236 [credits 15]: Algebra II**
Candidate must select any TWO (2) of the following modules:	
MAT 5132 [credits 15]: Functional Analysis	**MAT 5250 [credits 15]: Number Theory II**
MAT 5133 [credits 15]: Calculus of Variations	
MAT 5136 [credits 15]: Complex Analysis	
MAT 5138 [credits 15]: Number Theory I	
MAT 5140 [credits 15]: Matrix analysis	
COMPULSORY YEAR MODULES	
MAT 5301 [credits 30]: Project	
Total Credits only = 120	

MAT 5534 [credits 15]: Algebra I
Exact sequences of modules, Projective and injective modules, Simple and semi –simple modules, An outline of Homology theory, Tensor product of modules, Simple and Primitive Rings, The Jacobson Radical, Semi-simple rings, The Prime Radical and the Prime/Semi-prime rings.

MAT 5537 [credits 15]: Measure and Integration Theory
Set theory, rings, sigma-rings, fields, sigma-fields, Borel measure, measure, outer measure. Caratheodory, extension procedure for measures on a ring. Measurable functions. Lebesgue measure on a real line. Lebesgue integrals. Convergence Theorems. Fatou's Lemma and Fubini's theorem.

MAT 5532 [credits 15]: Functional Analysis
Metric spaces, Banach spaces, Hilbert spaces. Fundamental theorems for normed and Banach spaces. Banach's Fixed Point Theorem. Approximation theorem. Spectral theory of linear operators in normed spaces. Spectral theory of bounded self – adjoint operators

MAT 5533 [credits 15]: Calculus of Variations
The fundamental problem of calculus of variation. Euler differential equation. Euler Poisson equation. Ostradisky problem. Brachistochrone equation. Trasversalty condition. Extrema conditions. Jacobi condition. Legendre condition. Weierstrass condition. Canonical forms. Direct methods. Ritz method. Kantorovich method. Applications.

MAT 5536 [credits 15]: Complex Analysis
To be selected from the following topics: Conformal mappings. Singularities, Harmonic functions, Entire functions. Analytic function continuation. Asymptotic methods. Laplace transform and application.

MAT 5538 [credits 15]: Number Theory I
Divisibility, Prime Number, Greatest Common divisors and Prime factorization, Congruences, Multiplicative Functions, Primitive Roots, Quadratic Residues, Decimal Fractions and Continued Fractions and Nonlinear Diophantine equations.

MAT 5540 [credits 15]: Matrix analysis
Eigenvalues, eigenvectors and similarity. Unitary equivalence and normal matrices. Canonial forms. Hermitian and symmetric matrices. Matrix norms. Location and perturbation of matrices. Positive definite Matrices

MAT 5632 [credits 15]: General Topology
Basic set theory. Topological spaces and their construction. Continuous functions. Connectedness, compactness. Separation axioms. Urtsohn's Lemma. Tychonoff theorem. Stone-Cezh Compactification. Metrizable spaces.

MAT 5650 [credits 15]: Number Theory II
Introduction to combinatorics and the pidgeonhole principle, permutations and combinations, binomial coefficients and combinatorial identities, the principle of inclusion and exclusion, recurrence relations and generating functions.

MAT 5301 [credits 30]: Project
The research project shall be based on individual effort in the preparation of the research proposal and carrying out of the actual research with the assistance of a qualified member of Staff. The research shall be done on any topic of interest picked up from either pure mathematics or applied mathematics.

BSc HONS (MATHEMATICS) [CODE: MNHSHM] - package 2

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
MAT 5138 [credits 15]: Number Theory I	**MAT 5244 [credits 15]: Combinatorics II**
MAT 5144 [credits 15]: Combinatorics I	**MAT 5250 [credits 15]: Number Theory II**
Candidate must select any TWO (2) of the following modules:	
MAT 5134 [credits 15]: Algebra I	**MAT 5243 [credits 15]: Graph Theory**
MAT 5136 [credits 15]: Complex Analysis	**MAT 5252 [credits 15]: Partition Theory II**
MAT 5140 [credits 15]: Matrix analysis	
MAT 5151 [credits 15]: Theory of Computer Algebra	
MAT 5152 [credits 15]: Partition Theory I	
COMPULSORY YEAR MODULES	
MAT 5301 [credits 30]: Project	
Total Credits only = 120	

MAT 5138 [credits 15]: Number Theory I
Divisibility, Prime Number, Greatest Common divisors and Prime factorization, Congruences, Multiplicative Functions, Primitive Roots, Quadratic Residues, Decimal Fractions and Continued Fractions and Nonlinear Diophantine equations.

MAT 5144 [credits 15]: Combinatorics I
Introduction to combinatorics and the pidgeon hole principle, permutations and combinations, binomial coefficients and combinatorial identities, the principle of inclusion and exclusion, recurrence relations and generating functions.

MAT 5134 [credits 15]: Algebra I
Exact sequences of modules, Projective and injective modules, Simple and semi –simple modules, An outline of Homology theory, Tensor product of modules, Simple and Primitive Rings, The Jacobson Radical, Semi-simple rings, The Prime Radical and the Prime/Semi-prime rings.

MAT 5136 [credits 15]: Complex Analysis
To be selected from the following topics: Conformal mappings. Singularities, Harmonic functions, Entire functions. Analytic function continuation. Asymptotic methods. Laplace transform and application.

MAT 5140 [credits 15]: Matrix analysis
Eigenvalues, eigenvectors and similarity. Unitary equivalence and normal matrices. Canonial forms. Hermitian and symmetric matrices. Matrix norms. Location and perturbation of matrices. Positive definite Matrices

MAT 5151 [credits 15]: Theory of Computer Algebra
Introduction to cryptography, codes and computer algebra, fundamental algorithms, Euclidean algorithms and applications of Euclidean algorithms.

MAT 5152 [credits 15]: Partition Theory I
Elementary Theory of Patitions, Inversions in permutations and q – identities, Infinite series generating functions, Restricted partitions and permutaions.

MAT 5244 [credits 15]: Combinatorics II
Numbers, Powers and logarithms, Sums and products, Integer functions, Harmonic numbers, Fibonacci numbers, Bernoulli numbers and sequences, analysis of algorithm, Euler summation formula and asymptotic approximations.

MAT 5250 [credits 15]: Number Theory II
Introduction to combinatorics and the pidgeonhole principle, permutations and combinations, binomial coefficients and combinatorial identities, the principle of inclusion and exclusion, recurrence relations and generating functions.

MAT 5243 [credits 15]: Graph Theory
Structure of graphs, trees and connectivity, Eulerian and Hamilton graphs, planar graphs, graph embeddings, graph colorings and factorizations, subgraphs and degree sequence

MAT 5252 [credits 15]: Partition Theory II
Partition Identities, Jacobi's triple product, Gaussian polynomials and inversions, representation of numbers as sums of squares, Engel's expansion.

MAT 5301 [credits 30]: Project
The research project shall be based on individual effort in the preparation of the research proposal and carrying out of the actual research with the assistance of a qualified member of Staff. The research shall be done on any topic of interest picked up from either pure mathematics or applied mathematics.

BSc HONS (STATISTICS) [CODE: MNHSHS]

Select any FIVE (5) of the following modules:	
SEMESTER 1 MODULES:	**SEMESTER 2 MODULES:**
STA 5141 [credits 18]: Probability Theory	**STA 5241 [credits 18]: Demographic Methods**
STA 5142 [credits 18]: Multivariate Statistical Analysis	**STA 5242 [credits 18]: Time Series Analysis**
STA 5143 [credits 18]: Statistical Quality Control	**STA 5243 [credits 18]: Analysis of Discrete Data**
STA 5144 [credits 18]: Sampling Survey and Research Methods	**STA 5244 [credits 18]: Stochastic Processes**
STA 5145 [credits 18]: Generalised Linear Models	
COMPULSORY YEAR MODULES	
STA 5300 [credits 30]: Project	
Total Credits = 120	

STA 5541 [credits 18]: Probability Theory
Probability spaces and random variables. Distribution functions. Mathematical expectation. Conditional distribution and Independence. Characteristic Functions. Convergence concepts: Weak convergence, convergence in probability, convergence concepts. Laws of Large numbers. Central Limits Theorems and applications.

STA 5542 [credits 18]: Multivariate Statistical Analysis
Matrix Algebra and Multivariate normal distribution, Test of hypotheses on means and MANOVA. Classification by discriminant functions. Structure of multivariate components: principal components and factor analysis.

STA 5543 [credits 18]: Statistical Quality Control
Quality assurance (QAC) of a production process: control charts for attributes and for variables, specific QAC procedures, Acceptance Sampling Control, sequential sampling plans. Concepts of AQL, LTPQ, AOQL, ASN. Rectifying inspection. ASC for variables: known Standard deviation, unknown Standard deviation) ASC for continuous production. Statistical procedures for industrial experiments and optimization.

STA 5544 [credits 18]: Sampling Survey and Research Methods
Conceptual Issues in research, Statistical Issues in designing research, Sample Surveys and Designed Experiments. Cluster sampling. Multi-stage sampling. Complex surveys. Non-response and missing values. Categorical data analysis and regression in complex surveys.

STA 5545 [credits 18]: Generalised Linear Models
Introduction and review of Linear models; Model Fitting; Exponential Family and Generalized Linear Models; Estimation; Inference; Normal Linear Models; Binary Variables and Logistic Regression; Nominal and Ordinal Logistic Regression; Count Data, Poisson Regression and Log-Linear Models

STA 5641 [credits 18]: Demographic Methods
Data collection: census, survey, vital registration. Evaluation of data quality. Analysis of fertility. Analysis of mortality. Analysis of migration. Population development. Population health and economy.

STA 5642 [credits 18]: Time Series Analysis
Theoretical background of Box-Jenkins ARIMA and SARIMA models. Estimation and forecasting. Spectral density and spectral analysis. Stationary process in frequency domain. Modeling non-stationary time series. Modeling multivariate time series. Transfer function analysis. Linear systems in time and frequency domain.

STA 5643 [credits 18]: Analysis of Discrete Data
Cross-classified tables. Log-linear models. Hierarchical models. Model selection. Polytomous and multivariate response variables. Logistic regression

STA 5644 [credits 185]: Stochastic Processes
Elements of stochastic processes, Markov chains, Recurrence, Limit theorems of Markov Chains, Renewal processes, Martingales, Brownian motion

STA 5700 [credits 30]: BSc HONOURS PROJECT

8.4. MASTERS (MSc) QUALIFICATIONS OFFERED IN THE DEPARTMENT OF MATHEMATICAL AND COMPUTATIONAL SCIENCES IS BY RESEARCH AND BY MINI-PROJECT

8.4.1. MSc BY RESEARCH: ADMISSION REQUIREMENTS

Qualification	Qualification Code	Duration	Admission Requirements
MSc (Applied Mathematics)	MNMSAM	2 years	• A 4 years Bachelor degree or Honours degree in Pure Mathematics or Applied Mathematics with an average of 65%, an upper-second class for a class-based system with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • (c) Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.
MSc (Mathematics)	MNMMSM	2 years	• A 4 years Bachelor degree or Honours degree in Pure Mathematics or Applied Mathematics with an average of 65%, an upper-second class for a class-based system with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions.

			• Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.
MSc (Statistics)	MNMMSS	2 years	• A 4 years Bachelor degree or Honours degree in Statistics with an average of 65%, an upper-second class for a class-based system with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

8.4.2. MSc BY RESEARCH: RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(l) Before a candidate's application for registration can be considered, the title and topic of the proposed dissertation, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and the Faculty Higher Degrees Committee final approval. (m) The Research proposal, registration and ethics must be approved by the Deprtments Higher Degrees Committee and then send for final approval to the Faculty Higher Degrees Committee and UHDC. (n) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the Master's degree may be conferred only after the candidate has been registered for a period of at least TWO years fulltime. (o) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE. (p) The Research MSc degree is conferred based on a dissertation and an examination, or a dissertation only, as determined by the Faculty Academic Board. (q) The taught MSc degree is conferred based on a mini dissertation and a component of taught modules which must all be passed as per degree requirements (r) The Head of Department may prescribe certain ancillary modules which must be enrolled or passed before the date of the Master's examination. (s) The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture. (t) SENATE may, at any time, suspend or cancel the registration of any student who, in its view, is not making satisfactory progress. (u) Students who wish to defer their studies at **any stage MUST APPLY** to the relevant department. If granted, such deferment will be for **a maximum period of one year**, after which a further application must be submitted. Deferment will, **at most**, be granted twice. (v) Before registration for 2nd or further years, the student must write a full progress report for the year passed which is signed by the supervisor and the HOD to show progress, which will be approved /not approved by the Executive Dean. This progress report will count as the last quarterly report of the passed year for the student. **No** student will be allowed to register without the approval of the Executive Dean
ASSESSMENT CRITERIA	(c) Procedures as per post-graduate policies and guidelines will be followed – this includes the agreement between the student and supervisor that must be in placed as well as the quarterly reports that must be send to the Faculty Research office as proof of student's progress (d) Quarterly progress reports are compulsory

8.4.3. MSc BY COURSE WORK AND MINI DISSERTATION: ADMISSIONS REQUIREMENTS

Qualification	Quoailfication code	Duration	Admission requirements
MSc (e-Sciences)	MNMSES	2 years	• To qualify for this degree, an appropriate BSc Honours degree in Mathematics **or** Applied Mathematics **or** Statistics **or** Computer Science **or** Physics **or** its equivalent obtained from elsewhere. • Cross-disciplinary data-driven projects are offered both within the University and from a wide range of industry partners. • The first year is through WITS University where all the course work is taught. The second year is at UNIVEN where the mini project is done • A candidate must undertake and successfully complete the required modules [90 credits total] and a mini-project/dissertation [90 credits] to obtain the degree in one of the following departments: Mathematical and Computational Sciences **or** Physics [please discuss with the HOD of the specific department]. • Students are advised to seek for guidance from the HODs of Mathematical and Computational Sciences **or** Physics on matters concerning the programme and the required prerequisites for the modules, other than just a BSc Honours degree.

MSc IN E-SCIENCE [CODE: MNMSES]

YEAR 1 (WITS UNIVERSITY)	
COMPULSORY SEMESTER 1 MODULES:	**COMPULSORY SEMESTER 2 MODULES:**
MNS6101 [WITS:COMS7060A] (15 credits) Research Methods and Capstone Project in Data Science	**MNS6202 [WITS:COMS7055A]** (15 credits) Data Privacy and Ethics
SELECTIVE MODULES* (Select any 4 modules to make up 60 credits)	
MNS6103 [WITS:COMS7058A] (15 credits) Mathematical Foundations of Data Science	**MNS6206 [WITS:COMS7056A]** (15 credits) Data Visualisation and Exploration
MNS6104 [WITHS:COMS7063A] (15 credits) Statistical Foundations of Data Science	**MNS6207 [WITS:COMS7057A]** (15 credits) Large Scale Optimisation for Data Science
MNS6105 [WITS:COMS7047A] (15 credits) Adaptive Computation and Machine Learning	**MNS6208 [WITS:COMS7062A]** (15 credits) Special Topics in Data Science [Cybersecurity]
YEAR 2 (UNIVEN)	
MNS 6000 [credits 90] Research report: Data Science [Mini project/dissertation]	
Total credits - 180	

MNS6101 [WITS:COMS7060A] Research Methods and Capstone Project in Data Science (15 credits)
This module provided the theoretical and practical skills to plan, conduct, analyse and present a scientific assignment (Capstone Project) in the area of Data Science through Research methodologies;Ethics and Sustainability. The module is comprised of three parts: 1) Scientific writing; 2) Research Methodology; and 3) Scientific Assignments. These three parts are integrated in a Capstone Project.

MNS6202 [WITS:COMS7055A] Data Privacy and Ethics (15 credits)
This module introduces the ethical and legal foundations of data science governance. This topics covered include technical processes of data collection, storage, exchange and access; Ethical aspects of data management; Legal and regulatory frameworks in South Africa and in relevant jurisdictions; Data policies; Data privacy; Data ownership; Legal liabilities of analytical decisions and discrimination; and the Technical and algorithmic approaches to enhance data privacy, and relevant case studies.

MNS6103 [WITS: COMS7058A] Mathematical Foundations of Data Science (15 credits)
Advanced areas of data science require a deeper understanding of the fundamental mathematics pertaining to the field. In order to bridge this mathematical gap and provide a foundation for further learning this course will place more emphasis on topics such as high-dimensional space, best-fit subspaces and singular value decomposition, random walks and Markov chains, statistical machine learning, clustering, random graphs, topic models, non-negative matrix factorization, hidden Markov models, graphical models, wavelets, and sparse representations.

MNS6104 [WITS: COMS7063A] Statistical Foundations of Data Science (15 credits)
This module introduces the concepts and methodology of Data analysis. In particular the Explanatory Data Analysis (EDA) which falls under the general copy of Dta Analysis. EDA is a procedure which assists the discovering of new information from a given dataset. This module will focus on using descriptive statistics to clean and analyse datasets and thus leads to understanding of defining hypotheses for real life problem solving.

MNS6105 [WITS:COMS7047A] Adaptive Computation and Machine Learning (15 credits)
The module provides the candidate with an in-depth understanding of adaptive computing and machine learning. The module consists of machine learning, pattern recognition and computational learning theory in artificial intelligence. Machine learning explores the study and construction of algorithms that can learn from and make predictions using data – such algorithms

overcome following strictly static program instructions by making data driven predictions or decisions, through building a model from sample input.

MNS6206 [WITS:COMS7056A] Data Visualisation and Exploration (15 credits)
This module introduces the field of data visualization which seeks to determine and present underlying correlated structures and relationships in data sets from a wide variety of application areas. The prime objective of the presentation is to communicate the information in a dataset so-as-to enhance understanding. The module is comprised of the following subjects: Data and image models; Visualisation attributes (colour) and design (layout); Exploratory data analysis; Interactive data visualisation; Multidimensional data; Graphical perception; Visualisation software (Python & R); and Types of visualisation (Animation, Networks & Text).

MNS6207 [WITS:COMS7057A] Large Scale Computing Systems and Scientific Programming (15 credits) Advanced areas of data science require a deeper understanding of the large-scale discrete optimization methods pertaining to the field. In ode to bridge this mathematical gap and provide a foundation for further learning, this module will place more emphasis on topics such as convex optimisations, sub-gradient methods, localization methods, decomposition, and distributed optimization, proximal and operator splitting methods, conjugate gradients and nonconvex problems.

MNS6208 [WITS:COMS7062A] Special Topics in Data Science [Cybersecurity](15 credits)
This module deals with specialised and applied concepts and trends in the domain specific areas of data sciences such as finance, health sciences, bioinformatics, natural sciences, social sciences, smart cities, education, and energy.

MNS 6000 : Mini Research Project [credits 90]
The ability to do research is an essential skill for an individual pursuing a career in Data Science, and forms the basis for further post-graduate study. This module provides practical training for the development of research skills and bridges the gap between theory and practice, and established work and novel research. By working within established research structures in the Institution under the guidance of an expert, students will receive exposure to the methods, philosophy and ethos of research in the field of Data Science.

8.5. DOCTORAL (PhD) QUALIFICATIONS OFFERED BY THE DEPARTMENT OF MATHEMATICAL AND COMPUTATIONAL SCIENCES

8.5.1 PhD: ADMISSION REQUIREMENTS

Qualification	Qualification code	Duration	Admission requirements
PhD Mathematical Sciences (Statistics)	MNPPST	3 years	• A MSc in Statistics or e-Science with a minimum mark of 65% OR equivalent status conferred by SENATE • Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the Department's Higher Degrees Committee concerned for recommendation to the School's Higher Degree's committee and University higher degree's committee and approval by SENATE. The Research proposal must be approved by the • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.
PhD Mathematical Sciences (Mathematics)	MNPMSM	3 years	• A MSc in Pure Mathematics or Applied Mathematics or e-Science with a minimum mark of 65% OR equivalent status conferred by SENATE • Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the Department's Higher Degrees Committee concerned for recommendation to the School's Higher Degree's committee and University higher degree's committee and approval by SENATE. The Research proposal must be approved by the • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions.

			• Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.
PhD Applied Mathematics	MNPPAM	3 years	• A MSc in Pure Mathematics or Applied Mathematics or e-Science with a minimum mark of 65% OR equivalent status conferred by SENATE • Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the Department's Higher Degrees Committee concerned for recommendation to the School's Higher Degree's committee and University higher degree's committee and approval by SENATE. The Research proposal must be approved by the • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

8.5.2 PHD: RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(e) Before a candidate's application for registration can be considered, the title and topic of the proposed thesis, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and then the Faculty Higher Degrees Committee for approval. (f) The Research proposal, registration of project and ethics application must be approved by the Departments and Faculty's Higher Degrees Committee before final approval by the UHDC. (g) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the degree may be conferred only after the candidate has been registered for a period of at least THREE years fulltime. (h) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE.
ASSESSMENT CRITERIA	(e) Procedures as per Postgraduate policy guidelines will be followed. This will include the agreement between the supervisor and the doctoral student and the quarterly progress reports that must be submitted in time to the Faculty Research office (f) External examination of thesis will be done as per Post Graduate policies (g) Viva Voce as per school postgraduate guidelines through the office of the Executive Dean. If a student fails the Viva Voce, the degree will not be awarded. (h) Quarterly progress reports are compulsory

SECTION 9:

DEPARTMENT: PHYSICS

9.1. QUALIFICATIONS OFFERED BY THE DEPARTMENT OF PHYSICS

Generic BSc degrees (BSc):

• BSc (MATHEMATICS AND PHYSICS)		CODE: MNBBSH
• BSc (PHYSICS AND CHEMISTRY)		CODE: MNBBSJ

BSc Hons degrees (BSc.Hons)

• BSc HONS PHYSICS		CODE: MNHSHP

MSc degrees (MSc) by research:

• MSc PHYSICS	Project: PHY 6300	CODE: MNMMSP

MSc degrees (MSc) by mini project:

• MASTERS (e-SCIENCE)		CODE: MNMSES

PhD degrees (PhD):

• PhD PHYSICS	Project: PHY 7300	CODE: MNPDPP

9.2. GENERIC BACHELOR OF SCIENCE DEGREE (BSc) OFFERED BY THE DEPARTMENT OF PHYSICS

9.2.1 ADMISSIONS REQUIREMENTS, RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

ADMISSIONS REQUIREMENTS	(a) Candidates wishing to enroll for a Generic BSc degree in the Department of Biological Sciences in any of the undergraduate qualifications listed, must have obtained a minimum admission requirement in a National Senior Certificate (NSC) as certified by the Council for General and Further Education and Training (Umalusi) with an achievement rating of **4** (adequate achievement, 50-59%) or better in **each** of the following four recognised 20-credit NSC subjects: • English • Mathematics • Physical Science • Life Sciences (b) Any other related subject as judged by the HOD of the responsible department and approved by the Executive Dean of the Faculty (c) Candidates may be subjected to a selection procedure as determined by the Faculty board. (d) Equivalent FET Level 4 qualifications in any of the above subjects may also be considered. (e) Students from the Extended BSc Degree Programme should have obtained 120 credits from the 12 modules registered for, before admission to the listed mainstream degree.
RULES FOR PROGRESSION	**Students from the foundation year:** (a) All outstanding Foundation year modules **must be** registered for and passed during year 2 of the extended programme. (b) Students will not be allowed to move to year 3 of the extended programme or take any second-year mainstream modules if they still have **outstanding extended/foundation 1st year modules**. (c) A third-year extended programme student who has passed 60% of his/her second-year modules **may only** register third year modules whose Pre-requisites have been met, subject to the approval of the Head of Department and the Executive Dean. (d) Students may not select modules that clash on the lecturing and practical timetables. (e) No curriculum change, whether within or from outside the Faculty, will be recognized unless approved by the Executive Dean. (f) A full-time student may take a maximum of 32 credits over and above the minimum 360 credits required for the degree, **subject to the approval of the Head of Department and the Executive Dean**. (g) Students can register ONLY for modules for which **ALL** pre-requisites have been satisfied.

	(h) Students retain credits for all modules passed. (i) To qualify for a BSc degree in the Faculty, students must obtain a minimum of half of their credits in a learning stream within the Faculty of Sciene, Engineering and Agriculture. **Students registered for 3 year BSc degree:** (a) A student **may only progress to the second-year level** when she/he has passed 60% of the 1st year modules in the mainstream BSc degree (b) To progress to the third-year level, a student must have passed **ALL** first- and second-year modules. (c) Students may not select modules that clash on the lecturing and practical timetables. (d) No curriculum change, whether within or from outside the Faculty, will be recognized unless approved by the HOD and the Executive Dean. (e) A full-time student may take a maximum of 32 credits over and above the minimum 360 credits required for the degree, **subject to the approval** of the Head of Department and the Executive Dean. (f) Students can register **ONLY** for modules for which **ALL** Pre-requisites have been satisfied**.** (g) Students retain credits for all modules passed. (h) To qualify for a BSc degree in the School of Mathematical and Natural Sciences, students **must obtain a minimum** of half of their credits in a learning stream within this School. (i) To obtain a degree from the School, students must have earned at least 360 credits including all core and fundamental modules in one of the generic Bachelor of Science qualifications. Departments may prescribe additional credits **provided these do not exceed** 32 credits. (j) The minimum registration period for a BSc. degree is three years and the maximum is n+2.
ASSESSMENT CRITERIA	(a) Continuous Assessment will be determined by the Department and approved by the Faculty Board and consist of tests, practical sessions and tests, tutorials, projects, assignments and reports. (b) Students will write examinations at the end of each semester on condition that they qualify to do so. (c) The minimum final pass mark in any module is 50%. (d) To obtain the degree or diploma cum laude, a candidate must attain an aggregate of 75% or higher.

9.2.2. THE GENERIC BSc QUALIFICATIONS OFFERED IN THE DEPARTMENT OF PHYSICS

BSc (MATHEMATICS AND PHYSICS) **[CODE: MNBBSH]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**PHY 1121** (8): Mechanics **PHY 1122** (8): Waves and Optics I **MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematics Foundations I **CHE 1140** (16): General Chemistry for the Applied Sciences **ECS 1145** (10): English Communication Skills	**COM 1122** (8): Introduction to Computer Systems **COM 1124** (8): Fundamentals of Computer Architecture **STA 1141** (8): Introduction to Statistics **STA 1142** (8): Introductory Probability	**128**
	2	**PHY 1223** (8): Properties of Matter and Heat **PHY 1224** (8): Electricity and Magnetism **MAT 1241** (8): Integral Calculus **MAT 1242** (8): Mathematics Foundations II **MAT 1247** (8): Numerical Analysis I **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**STA 1241** (8): Elementary Statistical Methods I – Introductory Interference **STA 1242** (8): Elementary Statistical Methods II – Correlation and Regression	
	Year module	**COM 1321** (16): Object Oriented Programming		
Year 2 **NQF Level 6**	**1**	**PHY 2121** (10): Classical Mechanics **PHY 2122** (10): Waves and Optics II **MAT 2141** (10): Linear Algebra **MAT 2142** (10): Multivariable Calculus	**MAT 2148** (10): Mathematical Modelling I **COM 2123** (10): Imperative Programming **COM 2128** (10): Artificial Intelligence Fundamentals **COM 2129** (10): Database Fundamentals **STA 2141** (10): Probability Distributions	**120**
	2	**PHY 2223** (10): Electrodynamics **PHY 2224** (10): Modern Physics **MAT 2241** (10): Real Analysis I **MAT 2242** (10): Ordinary Differential Equations I **MAT 2247** (10): Numerical Analysis II **MAT 2248** (10): Vector Analysis	**CHE 2220** (10): Analytical Chemistry: Classical Techniques **CHE 2223** (10): Physical Chemistry I **STA 2241** (10): Statistical Computing	
Year 3 **NQF Level 7**	**1**	**PHY 3121** (14): Atomic and Nuclear Physics **PHY 3122** (14): Solid State Physics **MAT 3141** (14): Real Analysis II **MAT 3147** (14): Partial Differential Equations **MAT 3149** (14): Ordinary Differential Equations II	NONE	**126**
	2	**PHY 3223** (14): Thermodynamics and Statistical Mechanics **PHY 3224** (14): Quantum Mechanics **MAT 3241** (14): Complex Analysis	**MAT 3244** (14): Continuum Mechanics **MAT 3247** (14): Numerical Analysis III **MAT 3248** (14): Mathematical Modelling II	

In year 1:
- Take modules in total of 8 credits from the elective module list
- The compulsory year module must be registered in the 1st semester

In year 2:
- Take modules in total of 20 credits from the elective module list

In year 3:
- Take modules in total of 14 credits from the elective module list

BSc (PHYSICS AND CHEMISTRY) **[CODE: MNBBSJ]**

YEAR	SEMESTER	COMPULSORY MODULES	ELECTIVE MODULES	CREDITS
Year 1 **NQF Level 5**	**1**	**CHE 1140** (16): General Chemistry for the Applied Sciences **PHY 1121** (8): Mechanics **PHY 1122** (8): Waves and Optics I **MAT 1141** (8): Differential Calculus **MAT 1142** (8): Mathematics Foundation I **COM 0110** (4): Computer Literacy **ECS 1145** (10): English Communication Skills	**BIO 1141** (16): The Tree of Life **BIO 1142** (16): Cell Biology **COM 1321** (16): Object Oriented Programming **[Please note: this is a year module]** **STA 1141** (8): Introduction to Statistics	**136**
	2	**CHE 1221** (8): Inorganic Chemistry I **CHE 1222** (8): Organic Chemistry I **PHY 1223** (8): Properties of Matter and Heat **PHY 1224** (8): Electricity and Magnetism **MAT 1241** (8): Integral Calculus **MAT 1242** (8): Mathematics Foundation II **COM 0210** (4): Computer Literacy **ECS 1245** (10): English Communication Skills for Natural and Agricultural Sciences	**BIO 1243** (16): Ecology, Adaptation and Evolution **STA 1241** (8): Elementary Statistical Method I - Introductory Interference	
Year 2 **NQF Level 6**	**1**	**CHE 2121** (10): Inorganic Chemistry II **CHE 2122** (10): Organic Chemistry II **PHY 2121** (10): Classical Mechanics **PHY 2122** (10): Waves and Optics II **MAT 2141** (10): Linear Algebra **MAT 2142** (10): Multivariable Calculus	**COM 2123** (10): Imperative Programming **COM 2128** (10): Artificial Intelligence Fundamentals **COM 2129** (10): Database Fundamentals	**120**
	2	**CHE 2220** (10): Analytical Chemistry: Classical Techniques **CHE 2223** (10): Physical Chemistry I **PHY 2223** (10): Electrodynamics **PHY 2224** (10): Modern Physics	**COM 2229** (10): Systems Analysis **MAT 2241** (10): Real Analysis I **MAT 2242** (10): Ordinary Differential Equations I	
Year 3 **NQF Level 7**	**1**	**CHE 3120** (14): Analytical Chemistry: Instrumental Techniques **CHE 3123** (14): Physical Chemistry II **PHY 3121** (14): Atomic and Nuclear Physics **PHY 3122** (14): Solid State Physics	NONE	**112**
	2	**CHE 3221** (14): Inorganic Chemistry III **CHE 3222** (14): Organic Chemistry III **PHY 3223** (14): Thermodynamics and Statistical Mechanics **PHY 3224** (14): Quantum Mechanics	NONE	

In year 1:
- Take modules in total of 16 credits from the elective module list
- Take either COM 0110 **OR** COM 0210
- Please note that the **COM 1321** module is an elective and a year module which must be registered in the 1st semester

In year 2:
- Take modules in total of 20 credits from the elective module list

9.2.3. BSc: DESCRIPTION OF UNDERGRADUATE MODULES OFFERED BY THE DEPARTMENT OF PHYSICS PER SEMESTER

(a) SERVICE MODULES (Non-Calculus based Physics):

FIRST YEAR MODULES – SEMESTER 1:

Note: Natural (Biological & Health) Science students who require Physics MUST take this module:

PHY 1125 : Physics for Natural (Biological & Health) Sciences I [credits 8]
Motion in one and two dimensions, Newton's laws, Work, Energy, Power, Moments, elasticity, fluids, Temperature, Gas laws, Thermal properties of Matter. [Applications will be focused on Natural (Biological & Health) Sciences]

Note: Students taking degrees in the Environmental and Agricultural Science fields, who require Physics MUST take this module:

PHY 1127 : Physics for Environmental & Agricultural Sciences I [credits 12]
Motion in one and two dimensions, Newton's laws, Work, Energy, Power, Moments, elasticity, fluids, Temperature, Gas laws, Thermal properties of Matter. (Applications will be focused on Environmental & Agricultural Sciences)

FIRST YEAR MODULES – SEMESTER 2:

Note: Natural (Biological & Health) Science students who require Physics MUST take this module:

PHY 1225 : Physics for Natural (Biological & Health) Sciences II [credits 8]
Co-requisite : PHY 1125
Electrical forces and Potentials, Electric current and Nerve Conduction, Magnetism, Electromagnetic Induction, Geometrical Optics and Optical Instruments, Radioactivity, Atomic Structures and X-rays [Applications will be focused on Natural (Biological & Health Sciences)]

Note: Students taking degrees in the Environmental and Agricultural Science fields, who require Physics MUST take this module:

PHY 1227 : Physics for Environment & Agricultural Sciences II [credits 12]
Co-requisite : PHY 1527
Electrical forces and Potentials, Electric current and Nerve Conduction, Magnetism, Electromagnetic Induction, Geometrical Optics and Optical Instruments, Radioactivity, Atomic Structures and X-rays. (Applications will be focused on Environmental & Agricultural Sciences)

(b) MAIN STREAM MODULES (Calculus based Physics):

FIRST YEAR MODULES – SEMESTER 1:

PHY 1121 : Mechanics [credits 8]
Co-requisites : MAT 1141
Rectilinear Motion, Vectors, Motion in two dimensions, Newton's laws and their applications, Circular motion, Work, Energy, Power, Linear Momentum, static equilibrium.

PHY 1122 : Waves and Optics I [credits 8]
Co-requisites : MAT 1141
Description and Properties of Waves, Properties of Sound Waves, Doppler Effect, Spherical Mirrors, Lenses and their Applications, Wave Properties of Light, Interference.

FIRST YEAR MODULES – SEMESTER 2:

PHY 1223 : Properties of Matter and Heat [credits 8]
Co-requisites : MAT 1241
Elasticity, Fluid Mechanics, Temperature, Thermal expansions, Ideal Gas Law, Heat and First Law of Thermodynamics, Kinetic Theory of Gases, Heat Engines, Entropy and the Second Law of Thermodynamics.

PHY 1224 : Electricity and Magnetism [credits 8]
Co-requisites : MAT 1241
Electric Fields, Gauss' Law, Electric Potential, Capacitance and Dielectrics, Current and Resistance, Direct Current Circuits, Magnetic Fields, Sources of the Magnetic Fields (Biot-Savart Law)

SECOND YEAR MODULES – SEMESTER 1:

PHY 2121 : Classical Mechanics [credits 10]
Pre-requisites : PHY 1121, MAT 1141, MAT 1241
Vector Algebra, Rigid Body Dynamics, Angular Momentum, Moment of Inertia, General Motion in Three-Dimensions, Fundamentals of Lagrangian and Hamiltonian Mechanics.

PHY 2122 : Waves and Optics II [credits 10]
Pre-requisites : PHY 1122, MAT 1141, MAT 1241
Differential Wave Equations, Simple Harmonic Motion, Free and Forced Vibrations, Superposition of Waves, Group and Phase Velocities, Interference (by division of wave-fronts and amplitudes), Optical Interferometry, Diffraction, Polarisation.

SECOND YEAR MODULES – SEMESTER 2:

PHY 2223 : Electrodynamics [credits 10]
Pre-requisites : PHY 1224, MAT 1141, MAT 1241
Electrostatics, Electric Fields in Matter, Magnetostatics, Magnetic Fields in Matter, Electrodynamics, and AC Circuit Analysis.

PHY 2224 : Modern Physics [credits 10]
Pre-requisites : PHY 1121, MAT 1141, MAT 1241
Special Theory of Relativity, Quantization of Charge, Light and Energy, Photo-electric and Compton Effects, Wave-like Properties of Particles, Schrödinger Equation.

THIRD YEAR MODULES – SEMESTER 1:

Students are not allowed to proceed to do third year modules before clearing all first year modules.

PHY 3121 : Atomic and Nuclear Physics [credits 14]
Pre-requisites : PHY 2224
Rutherford Scattering, Bohr Atomic Model, Correspondence Principle, Atomic Spectra, Nuclear Properties, Nuclear Forces, Nuclear Models, Nuclear Decay and Radioactivity, Nuclear Reactions.

PHY 3122 : Solid State Physics [credits 14]
Pre-requisites : PHY 2121, PHY 2224
Crystallography, X-ray Diffraction, Crystal Defects, Lattice Vibrations, Heat Capacity, Metallic behaviour and Free Electron Gas, Energy Bands.

PHY 3125 : Energy Physics [credits 14]
Pre-requisites :PHY 2122, PHY 2223
Theory and Technology on the Production, Transmission and Storage of Energy with Special Reference to the Physics of Nuclear Energy, Electrical Energy, Solar Energy, Wind Energy And Fuel Cells.

THIRD YEAR MODULES – SEMESTER 2:

PHY 3223 : Thermodynamics and Statistical Mechanics [credits 14]
Pre-requisites : PHY 2121
Laws of Thermodynamics and their Applications, Joule-Thompson Effect, Chemical Potential, Basic Concepts of Statistical Mechanics, Maxwell-Boltzmann Statistics, Bose-Einstein Statistics, Fermi-Dirac Statistics.

PHY 3224 : Quantum Mechanics [credits 14]
Pre-requisites : PHY 2224
Schrödinger Equation and Probability Interpretation, Eigenfunctions and Eigenvalues, One-dimensional Potentials, Operator Methods, Harmonic Oscillator, Schrödinger Equation in Three Dimensions, Angular Momentum, Hydrogen Atom.

PHY 3226 : Electronics [credits 12]
Pre-requisites : PHY 2223
DC Circuit Theorems, Semiconductor Diodes, Diode Applications, Bipolar Junction Transistors, DC Biasing: BJT's, Field-Effect Transistors, FET Biasing, Operational Amplifiers.

PHY 3227 : Project [credits 12]
Pre-requisites : PHY 2121, PHY 2122, PHY 2223, PHY 2224

9.3 BACHELOR OF SCIENCE HONOURS DEGREE [BSc. Hons] OFFERED BY THE DEPARTMENT OF PHYSICS

9.3.1. ADMISSION REQUIREMENTS

Qualification	Qualification code	Duration	Admission requirements
BSc Hons (Physics)	MNHSHP	1 year	• A candidate will be allowed to register for the Honours degree in Physics only if he/she possesses a BSc degree or equivalent or subject to SENATE approval, if he/she has completed the modules for a BSc degree, or if equivalent status has been conferred on him/her by SENATE. • Candidates must have passed the final-year modules of the subject in which they wish to study with an aggregate of 60%. Candidates with lower level passes may be accepted subject to SENATE approval. • Prospective candidate could be subjected to a final selection test which serves to assess their preparedness for the Honours course.

9.3.2. RULES FOR PROGRESSION AND ASSESSMENT

RULES FOR PROGRESSION	(a) The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture. (b) The honours degree is offered over ONE academic year and students write examinations and present themselves for continuous assessment during the year of registration. (c) **Project reports must be handed in before the 30th November of the academic year to graduate in the following May graduation.** (d) Except with the special permission of SENATE, the duration of the full-time study **will not exceed TWO years** (e) The degree will not be conferred on a candidate before at least one year has elapsed since he/she obtained the Bachelor's degree or another undergraduate degree as set out in the Faculty rules and unless he/she has been registered for one year at this University.
ASSESSMENT CRITERIA	(a) Candidates will only be assessed in a specific module if they attended lectures, tutorials and prescribed practical satisfactorily and obtained a semester mark of at least 50%. (b) A student **must** attain a minimum of 50% pass in **each** of the components of assessment. A student, who fails one of these components, will be allowed to repeat only that component. The written examination component will be conducted during the next normal examination period for that specific module. (c) All written examinations will be taken only during official examination sessions**.** (d) A candidate who fails two modules in the degree and obtains an aggregate of at least 50% may be admitted for assessment in those modules on one further sitting. (e) To obtain the degree cum laude, a candidate must attain an aggregate of 75% or higher. (f) To be awarded the BSc Hons degree, the candidate must accumulate at least 120 credits at this level. (g) Special examinations **will not be offered** in the BSc Hons degree. (h) An Aegrotat Examination may be granted to a student who has been prevented from sitting for the examination: • By illness on the day of the examination or assessment, or immediately before the examination or assessment, if a medical certificate from a registered medical practitioner is submitted to the Faculty, and/or if the student's application is supported by the invigilator concerned or another responsible person; or • Because of domestic circumstances such as serious illness or death of a close relative during the examination or assessment, or other reasons, if the Faculty judges it to be a bona fide case, and the student can provide satisfactory proof of such extraordinary circumstances.

9.3.3. BSc HONS: QUALIFICATIONS AND MODULE DESCRIPTIONS

BSc HONS (PHYSICS) **[CODE: MNHSHP]**

To qualify for the degree, a student must pass ***eight modules***. The fundamental modules and optional modules offered in an academic year vary depending on the staffing situation in the department. Students are advised to consult the Head of department about the modules offered in a year.

COMPULSORY SEMESTER 1 MODULES:	COMPULSORY SEMESTER 2 MODULES:
PHY 5121 [credits 14]: Classical Mechanics	**PHY 5221 [credits 14]: Electrodynamics**
PHY 5122 [credits 14]: Quantum Mechanics I	**PHY 5222 [credits 14]: Statistical Mechanics**
PHY 5123 [credits 14]: Solid State Physics I	**PHY 5223 [credits 30]: Project (core)**
Candidate must select any TWO (2) of the following modules:	
PHY 5124 [credits 10]: Renewable Energy	**PHY 5224 [credits 10]: Solid State Physics II**
PHY 5125 [credits 10]: Mathematical Methods of Physics	**PHY 5225 [credits 10]: Quantum Mechanics II**
PHY 5126 [credits 10]: Laser Physics I	**PHY5226 [credits 10]: Laser Physics II**
PHY 5127 [credits 10]: Electronics	**PHY 5227 [credits 10]: Nuclear and Particle Physics**
Total Credits only = 120	

PHY 5521 [credits 14]: Classical Mechanics (core)
Application of Lagrangian and Hamiltonian Mechanics, Central Force Field, Theory of Vibration, Canonical Transformation, Poisson's and Lagrange's Brackets.

PHY 5522 [credits 14]: Quantum Mechanics I (core)
Schrödinger Equation, Wave Function and Operator Algebra, Principles of Wave Mechanics, Harmonic Oscillator, One-dimensional Potentials, The WKB Approximation, Variational Methods, Vector Space, Eigenvalues and Eigenvectors of Operators and Applications.

PHY 5523 [credits 14]: Solid State Physics I (core)
Crystal Bonding, Free Electron Theory of Metals, the Quantized Free Electron Theory, the Band Theory, Magnetic Properties of Solids, Ferromagnetism, Anti-Ferromagnetism and Ferrimagnetism

PHY 5524 [credits 10]: Renewable Energy
Solar radiation, Solar Cells and Collectors and Applications, Wind Energy, Bio-Mass, Bio-Fuels, Environmental Effects.

PHY 5525 [credits 10]: Mathematical Methods of Physics
Vector Calculus, Matrices and Applications, Fourier Transforms, Special Functions and Polynomials, Integral Transforms.

PHY5526 [credits 10]: Laser Physics I
Will be offered in collaborations with National Laser Centre, CSIR

PHY 5527 [credits 10]: Electronics
Semiconductor Devices, Transistor Amplifiers (Single and Multiple transistors), Operational and Feedback Amplifiers and its Applications, Digital Circuits and Integrated Circuits, Logic Gates, Flip-flops, Multi-vibrators and Digital to Analogue and Analogue to Digital Converters

PHY 5621 [credits 14]: Electrodynamics (core)
Electrostatics, Boundary Value Problems, Green Functions, Multipole Expansion, Dielectric Media, Magnetostatics, Time-varying Fields, Maxwell's Equations.

PHY 5622 [credits 14]: Statistical Mechanics (core)
Methods of Ensembles, Rotational, Vibrational and Nuclear Spin Effect of Simple Molecules, Applications of Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac Statistics.

PHY 5623 [credits 30]: Project (core)

PHY 5624 [credits 10]: Solid State Physics II
Pre-requisites : PHY 5523
Phonons I: Crystal vibrations, Phonon II: Thermal Properties, Thermal Conductivity, Imperfection in Crystals, Optical Properties and Physics of Semiconductors.

PHY 5625 [credits 10]: Quantum Mechanics II
Pre-requisites : PHY 5522
Angular Momentum, Spherically Symmetric Potentials, Scattering, Principles of Quantum Dynamics, Spin, Rotations and other Symmetry Operations, Perturbation Theory.

PHY5626 [credits 10]: Laser Physics II
Pre-requisites : PHY 5526
Will be offered in collaborations with National Laser Centre, CSIR

PHY 5627 [credits 10]: Nuclear and Particle Physics
Pre-requisites : PHY 5522
Nucleon Structure, Nuclear Forces, Bulk Properties of Nuclei, Nuclear Excitation and Decay, Elementary Particle Dynamics, Symmetries, Bound States, Feynman Calculus.

9.4. MASTERS (MSc) QUALIFICATIONS OFFERED IN THE DEPARTMENT OF PHYSICS IS DONE BY RESEARCH AND BY MINI PROJECT

9.4.1. MSc BY RESEARCH: ADMISSION REQUIREMENTS

Qualification	Qualification code	Duration	Admission Requiremnts
MSc Physics	MNMMSP	2 years	• A 4 years Bachelor degree or Honours degree in Physics with an average of 65%, an upper-second class for a class-based system with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

9.4.2. MSC BY RESEARCH: RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title and topic of the proposed dissertation, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and the Faculty Higher Degrees Committee final approval. (b) The Research proposal, registration and ethics must be approved by the Deprtments Higher Degrees Committee and then send for final approval to the Faculty Higher Degrees Committee and UHDC. (c) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the Master's degree may be conferred only after the candidate has been registered for a period of at least TWO years fulltime. (d) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE. (e) The Research MSc degree is conferred based on a dissertation and an examination, or a dissertation only, as determined by the Faculty Academic Board. (f) The taught MSc degree is conferred based on a mini dissertation and a component of taught modules which must all be passed as per degree requirements (g) The Head of Department may prescribe certain ancillary modules which must be enrolled or passed before the date of the Master's examination. (h) The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture. (i) SENATE may, at any time, suspend or cancel the registration of any student who, in its view, is not making satisfactory progress. (j) Students who wish to defer their studies at **any stage MUST APPLY** to the relevant department. If granted, such deferment will be for **a maximum period of one year**, after which a further application must be submitted. Deferment will, **at most**, be granted twice. (k) Before registration for 2nd or further years, the student must write a full progress report for the year passed which is signed by the supervisor and the HOD to show progress, which will be approved /not approved by the Executive Dean. This progress report will count as the last quarterly report of the passed year for the student. **No** student will be allowed to register without the approval of the Executive Dean
ASSESSMENT CRITERIA	(a) Procedures as per post-graduate policies and guidelines will be followed – this includes the agreement between the student and supervisor that must be in placed as well as the

	quarterly reports that must be send to the Faculty Research office as proof of student's progress (b) Quarterly progress reports are compulsory

9.4.3. MSc BY COURSE WORK AND MINI DISSERTATION: ADMISSIONS REQUIREMENTS

Qualification	Quoailfication code	Duration	Admission requirements
MSc (e-Sciences)	MNMSES	2 years	• To qualify for this degree, an appropriate BSc Honours degree in Mathematics **or** Applied Mathematics **or** Statistics **or** Computer Science **or** Physics **or** its equivalent obtained from elsewhere. • Cross-disciplinary data-driven projects are offered both within the University and from a wide range of industry partners. • The first year is through WITS University where all the course work is taught. The second year is at UNIVEN where the mini project is done • A candidate must undertake and successfully complete the required modules [90 credits total] and a mini-project/dissertation [90 credits] to obtain the degree in one of the following departments: Mathematical and Computational Sciences **or** Physics [please discuss with the HOD of the specific department]. • Students are advised to seek for guidance from the HODs of Mathematical and Computational Sciences **or** Physics on matters concerning the programme and the required prerequisites for the modules, other than just a BSc Honours degree.

MSc IN E-SCIENCE [CODE: MNMSES]

YEAR 1 (WITS UNIVERSITY)	
COMPULSORY SEMESTER 1 MODULES:	**COMPULSORY SEMESTER 2 MODULES:**
MNS6101 [WITS:COMS7060A] (15 credits) Research Methods and Capstone Project in Data Science	**MNS6202 [WITS:COMS7055A]** (15 credits) Data Privacy and Ethics
SELECTIVE MODULES* (Select any 4 modules to make up 60 credits)	
MNS6103 [WITS:COMS7058A] (15 credits) Mathematical Foundations of Data Science	**MNS6206 [WITS:COMS7056A]** (15 credits) Data Visualisation and Exploration
MNS6104 [WITHS:COMS7063A] (15 credits) Statistical Foundations of Data Science	**MNS6207 [WITS:COMS7057A]** (15 credits) Large Scale Optimisation for Data Science
MNS6105 [WITS:COMS7047A] (15 credits) Adaptive Computation and Machine Learning	**MNS6208 [WITS:COMS7062A]** (15 credits) Special Topics in Data Science [Cybersecurity]
YEAR 2 (UNIVEN)	
MNS 6000 [credits 90] Research report: Data Science [Mini project/dissertation]	
Total credits - 180	

MNS6101 [WITS:COMS7060A] Research Methods and Capstone Project in Data Science (15 credits)
This module provided the theoretical and practical skills to plan, conduct, analyse and present a scientific assignment (Capstone Project) in the area of Data Science through Research methodologies;Ethics and Sustainability. The module is comprised of three parts: 1) Scientific writing; 2) Research Methodology; and 3) Scientific Assignments. These three parts are integrated in a Capstone Project.

MNS6202 [WITS:COMS7055A] Data Privacy and Ethics (15 credits)
This module introduces the ethical and legal foundations of data science governance. This topics covered include technical processes of data collection, storage, exchange and access; Ethical aspects of data management; Legal and regulatory frameworks in South Africa and in relevant jurisdictions; Data policies; Data privacy; Data ownership; Legal liabilities of analytical decisions and discrimination; and the Technical and algorithmic approaches to enhance data privacy, and relevant case studies.

MNS6103 [WITS: COMS7058A] Mathematical Foundations of Data Science (15 credits)
Advanced areas of data science require a deeper understanding of the fundamental mathematics pertaining to the field. In order to bridge this mathematical gap and provide a foundation for further learning this course will place more emphasis on topics such as high-dimensional space, best-fit subspaces and singular value decomposition, random walks and Markov chains, statistical machine learning, clustering, random graphs, topic models, non-negative matrix factorization, hidden Markov models, graphical models, wavelets, and sparse representations.

MNS6104 [WITS: COMS7063A] Statistical Foundations of Data Science (15 credits)
This module introduces the concepts and methodology of Data analysis. In particular the Explanatory Data Analysis (EDA) which falls under the general copy of Dta Analysis. EDA is a procedure which assists the discovering of new information from a given dataset. This module will focus on using descriptive statistics to clean and analyse datasets and thus leads to understanding of defining hypotheses for real life problem solving.

MNS6105 [WITS:COMS7047A] Adaptive Computation and Machine Learning (15 credits)
The module provides the candidate with an in-depth understanding of adaptive computing and machine learning. The module consists of machine learning, pattern recognition and computational learning theory in artificial intelligence. Machine learning explores the study and construction of algorithms that can learn from and make predictions using data – such algorithms overcome following strictly static program instructions by making data driven predictions or decisions, through building a model from sample input.

MNS6206 [WITS:COMS7056A] Data Visualisation and Exploration (15 credits)
This module introduces the field of data visualization which seeks to determine and present underlying correlated structures and relationships in data sets from a wide variety of application areas. The prime objective of the presentation is to communicate the information in a dataset so-as-to enhance understanding. The module is comprised of the following subjects: Data and image models; Visualisation attributes (colour) and design (layout); Exploratory data analysis; Interactive data visualisation; Multidimensional data; Graphical perception; Visualisation software (Python & R); and Types of visualisation (Animation, Networks & Text).

MNS6207 [WITS:COMS7057A] Large Scale Computing Systems and Scientific Programming (15 credits) Advanced areas of data science require a deeper understanding of the large-scale discrete optimization methods pertaining to the field. In ode to bridge this mathematical gap and provide a foundation for further learning, this module will place more emphasis on topics such as convex optimisations, sub-gradient methods, localization methods, decomposition, and distributed optimization, proximal and operator splitting methods, conjugate gradients and nonconvex problems.

MNS6208 [WITS:COMS7062A] Special Topics in Data Science [Cybersecurity](15 credits)
This module deals with specialised and applied concepts and trends in the domain specific areas of data sciences such as finance, health sciences, bioinformatics, natural sciences, social sciences, smart cities, education, and energy.

MNS 6000 : Mini Research Project [credits 90]
The ability to do research is an essential skill for an individual pursuing a career in Data Science, and forms the basis for further post-graduate study. This module provides practical training for the development of research skills and bridges the gap between theory and practice, and established work and novel research. By working within established research structures in the Institution under the guidance of an expert, students will receive exposure to the methods, philosophy and ethos of research in the field of Data Science.

9.5. DOCTORAL (PhD) QUALIFICATIONS OFFERED BY THE DEPARTMENT OF PHYSICS IS BY RESEARCH ONLY

9.5.1 ADMISSION REQUIREMENTS

Qualification	Qualification code	Duration	Admission requirements
PhD Physics	MNPDPP	3 years	• A MSc in Physics with a minimum mark of 65% OR equivalent status conferred by SENATE • Before a candidate's application for registration can be considered, the title or topic of the proposed thesis, together with a brief outline of the research must be submitted to the Department's Higher Degrees Committee concerned for recommendation to the School's Higher Degree's committee and University higher degree's committee and approval by SENATE. The Research proposal must be approved by the • An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. • Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

9.5.2 RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title and topic of the proposed thesis, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and then the Faculty Higher Degrees Committee for approval. (b) The Research proposal, registration of project and ethics application must be approved by the Departments and Faculty's Higher Degrees Committee before final approval by the UHDC.

	(c) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the degree may be conferred only after the candidate has been registered for a period of at least THREE years fulltime. (d) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE.
ASSESSMENT CRITERIA	(a) Procedures as per Postgraduate policy guidelines will be followed. This will include the agreement between the supervisor and the doctoral student and the quarterly progress reports that must be submitted in time to the Faculty Research office (b) External examination of thesis will be done as per Post Graduate policies (c) Viva Voce as per school postgraduate guidelines through the office of the Executive Dean. If a student fails the Viva Voce, the degree will not be awarded. (d) Quarterly progress reports are compulsory

SECTION 10:

DEPARTMENT: SCIENCE FOUNDATION

10.1. QUALIFICATION OFFERED BY THE DEPARTMENT OF SCIENCE FOUNDATION

The following streams are available within the extended BSc degree:

- Extended BSc (BIOCHEMISTRY AND MICROBIOLOGY) CODE: MNEBSA
- Extended BSc (BIOCHEMISTRY AND BIOLOGY) CODE: MNEBSD
- Extended BSc (MICROBIOLOGY AND BOTANY) CODE: MNEBSE
- Extended BSc (MATHEMATICS AND APPLIED MATHEMATICS) CODE: MNEBSF
- Extended BSc (FINANCIAL MATHEMATICS AND APPLIED MATHEMATICS) CODE: MNEBSG
- Extended BSc (MATHEMATICS AND PHYSICS) CODE: MNEBSH
- Extended BSc (MATHEMATICS AND STATISTICS) CODE: MNEBSI
- Extended BSc (PHYSICS AND CHEMISTRY) CODE: MNEBSJ
- Extended BSc (CHEMISTRY AND MATHEMATICS) CODE: MNEBSK
- Extended BSc (CHEMISTRY AND BIOCHEMISTRY) CODE: MNEBSL
- Extended BSc (CHEMISTRY AND APPLIED CHEMISTRY) CODE: MNEBSN
- Extended BSc (BOTANY AND ZOOLOGY) CODE: MNEBSO
- Extended BSc (COMPUTER SCIENCE) CODE: MNEBSP
- Extended BSc (COMPUTER SCIENCE AND MATHEMATICS) CODE: MNEBSQ

10.2. ADMISSION REQUIREMENTS, RULES FOR PROGRESSION AND ASSESSMENT CRITERIA FOR THE EXTENDED BSc QUALIFICATION OFFERED BY THE DEPARTMENT OF SCIENCE FOUNDATION

ADMISSIONS REQUIREMENTS	a) Candidates with a National Senior Certificate (NSC) stipulating admission to a bachelor's degree, and an achievement rating of **3** (40-49%) or better in matric English, Mathematics, Physical Science, Life Sciences [and any other related subject as judged by the HOD of responsible departments and approved by the Executive Dean of the School of Mathematical and Natural Sciences], may be admitted to the Extended BSc degree Programme. b) Approved qualifications for which students will be registered in the Extended Degree: BSc (Bachelor of Science) with specific approved streams BENVSC (Environmental Sciences) BENVM (Environmental Sciences) BSCAGR (Agriculture)
RULES FOR PROGRESSION	(a) The BSc Extended Degree will be for a four (4)-year duration. (b) For a student to proceed to the 2nd year of mainstream studies, he/she **MUST** obtain 120 credits in the 1st year of the Extended Degree. (c) A student who failed to pass at least 6 modules **will not** be allowed neither to repeat the failed modules **nor to continue** with his/her studies. (d) A student who failed 3 OR 4 OR 5 modules can repeat the failed modules **ONLY ONE TIME**, of which failure to reach the minimum required 120 credits, the studies will be discontinued. (e) All Foundation modules must have been passed in year 2 of the extended degree. Students will not be allowed to continue before all Foundation modules are passed.
ASSESSMENT CRITERIA	(a) Continuous Assessment will consist of tests, practical, tutorials, projects, assignments and reports. (b) Students will write examinations at the end of each semester on condition that they qualify to do so. (c) The minimum final pass mark in any module is 50%. (d) To obtain the degree or diploma *cum laude*, a candidate must attain an aggregate of 75% or higher.

Students will after successful completion of the 1st year extended BSc qualifiaction, be allowed to continue in the mainstream BSc qualification.

Information on the 2nd, 3r and 4th years can be seen under the BSc qualifications under each department which clearly describe each of the BSc mainstream qualifications and provides detailed descriptions of the modules under each qualification.

YEAR	SEMESTER	COMPULSORY MODULES	CREDITS
Year 1	**1**	**FGS 1140** (12): Foundation Skills & Study Skills 1 **FIT 1140** (12): Information Technology Fundamentals 1 **FMT 1140** (12): Foundation Mathematics 1 **FPH 1140** (12): Foundation Physics 1 **FCH 1140** (12): Foundation Chemistry1 **FBI 1140** (12): Foundation Biology 1	**144**
	2	**FGS 1240** (12): Foundation Skills & Study Skills 1 **FIT 1240** (12): Information Technology Fundamentals 1 **FMT 1240** (12): Foundation Mathematics 1 **FPH 1240** (12): Foundation Physics 1 **FCH 1240** (12): Foundation Chemistry1 **FBI 1240** (12): Foundation Biology 1	

10.3. DESCRIPTION OF MODULES OFFERED IN THE FIRST YEAR OF THE EXTENDED BSc DEGREE

FIRST YEAR MODULES: - FIRST SEMESTER

FGS 1140: Foundation Skills & Study Skills 1 [credits 12]
This is a first semester module which addresses Foundation students' linguistic and study skills, competence and performance and lays the foundation for their success throughout their university studies. The orientation of this module is the teaching of grammatical structures, study skills and academic writing skills for Science Foundation students to be able to succeed in their studies. Proficiency in a language is determined by one's ability to speak, read, write and listen with understanding to a language. This module aims to develop these language components within the context of the Science domain using texts and exercises largely drawn from Science related texts. The module will also improve the accuracy with which students use English in order to facilitate effective communication. The purpose of this course is to lay a strong foundation in the students' use of English and to develop their competence in oral and written communication in contexts related to their university studies and future workplace. As language is central to all teaching and learning activities at university, this module is closely linked to all other modules in the Science Foundation Programme. This module contributes to the competent completion and presentation of oral and written assignments and reports in other modules.

FIT 1140: Information Technology Fundamentals 1 [credits 12]
This course develops familiarity with modern computers and encourages their productive use. The module is designed for those with little or no prior computer background. Even if students have some experience about computers already, they might find that there is still a lot to learn! The course content is divided into the theoretical and practical components as follows:
Theory: Uses of computers; components of a computer (hardware); processor; memory; input devices; output devices; computer software; computer networks and the Internet and an introduction to basic HTML.
Practical: Use of the operating system; the file system; file management; the World Wide Web; electronic mail; and creation of Web Pages using HTML.

FMT 1140: Foundation Mathematics 1 [credits 12]
Foundation Mathematics is an introductory course designed to equip students with a good foundation in Mathematics. The course is divided into Algebra, Calculus, and Descriptive statistics frequency distribution and graphs. The following content is covered in this first semester module in order to lay a solid Mathematics foundation for the Science Foundation students: Powers, estimation and proportion; Using binary operations in algebra factorization and rational expression; Solving linear, quadratic and absolute value equations and inequalities; Differentiation, higher derivatives and application of differentiation as well as an overview of Statistics.

FPH 1140: Foundation Physics 1 [credits 12]
This is a first semester module which deals with the following concepts: *Measurements in Physics:* SI base and derived units; conversion of units; significances figures. *Vectors in Physics:* scalar and Vector quantities; vector representation; vector addition and subtraction; Vector components. *Motion in one and two dimensions:* average/instantaneous velocity and speed; kinematics equations; Free fall; Projectile Motion. *Laws of Motion and Momentum:* Newton's First Law of motion; inertia; Newton's second Law of motion; Force; weight; frictional forces; universal law of gravitation; mass and weight; impulse and momentum; change in momentum; types of collisions; conservation of linear momentum. *Work, power and energy:* work done by a force; kinetic energy; potential energy; conservative force; mechanical energy; work energy theorem. *Rotational Dynamics and static Equilibrium:* Torque; Center of mass and balance. *Hydrostatics and Thermodynamics:* Phases and Phase change; Phase equilibrium and Evaporation; Laws of Thermodynamics; Specific Heats; Conduction; Convection and Radiation.

FCH 1140: Foundation Chemistry 1 [credits 12]
The course aims to develop a broader knowledge and scope of the concept of Chemistry, as well as improve the students' understanding while promoting creativity. The course was mainly designed for Science Foundation students who under-performed in their Physical Science during their Grade 12 examination. The course aims to equip students with a better foundational level of Chemistry for entry into the mainstream. The pre-requisite for this course is that all learners must have studied Grade 12 Physical Science. The course also aims to introduce students to a more in-depth level of Chemistry as compared to what was taught at High School level. Revision of the Chemistry concepts taught in High School will firstly be dealt with to determine the students' understanding and prior knowledge of Chemistry. Introduction to more complex Stoichiometric Calculations will follow, together with an overview of the atomic structure and the scientists responsible for the origins of these. The periodic table and the various properties will be assessed, together with the types of Chemical Bonding. In Inorganic Chemistry, the various Sulphur and Nitrogen compounds and halogens will be taught.

FBI 1140: Foundation Biology 1 [credits 12]
The module aims to introduce students to different biological disciplines such as Medicine, Pharmacology, Bacteriology, Parasitology, etc. It also introduces students to the use and handling of a microscope. Furthermore, students will be given practical laboratory exposure to make certain that they are familiar with the use and handling of the microscope. Students will also familiarize with two different biological cells; they will know how to draw and label the various parts of these biological cells.

FIRST YEAR MODULES: - SECOND SEMESTER

FGS 1240: Foundation Skills & Study Skills 1 [credits 12]
This is a second semester module which builds upon the linguistic knowledge and study skills acquired in the first semester and further develops Foundation students' linguistic competence and performance by developing their academic writing skills to enable them to succeed in their studies. Students are taught how to develop their knowledge of sentence construction into paragraph and essay writing. The module introduces students to general and scientific report writing as well as field reports with the foresight of preparing them for any field work that they may be required to undertake during the Science Foundation Programme as well as the rest of their undergraduate studies. In this module, students are also introduced to basic academic writing and referencing techniques and made aware of the seriousness of plagiarism as a serious academic offence and how best to avoid it.

FIT 1240: Information Technology Fundamentals 1 [credits 12]
This is a second semester course which is designed to develop knowledge with Application Software Package and to help students get used to different software application packages. It also introduces students to the basic notion of programming using C++. Although technology changes very rapidly, the basic knowledge stays the same. This module is designed for those with little or no prior computer background. But the course builds upon the basics taught in **FIT 1140**. This course covers the general theory of how to use application software packages, as well as standard and advanced practical uses of different Software Application Packages. The course also introduces basic concepts of programming using C++. The course content is divided into the theoretical and practical components where the following are taught:
Theory: Uses of computers, theoretical aspects of word processors, spreadsheets, databases, presentation and introduction to basic concepts of C++.
Practical: Use of operating system, Advance Training in Microsoft Package (Word, PowerPoint, Excel, and Access), code block and other software applications.

FMT 1240: Foundation Mathematics 1 [credits 12]
This is a second semester module which is designed to equip students with a good foundation in Mathematics and build upon the mathematical concepts taught in first semester. The course will include *Integration*: specifically

indefinite and definite integrations for algebra; exponential, trigonometric and logarithmic functions; Calculation of area of the curve and solids of revolutions; *Matrices*: proving commutative of a square matrix; demonstration of multiplication of matrices; calculation determination and inverses of matrices of 2 by 2 and more sizes. *Trigonometry*: conversion of degrees into radians and angles of depression; solving trigonometric equations and triangles and *Exponential functions*: solving an exponential function and sketch the curves, Determinations of domain, Range and asymptote of the curve; Conversion for logarithmic functions into an exponential function as well as solving logarithmic functions.

FPH 1240: Foundation Physics 1 [credits 12]
This module deals with the following concepts: *Electricity and Magnetism*: Electric charge; electric Force and coulomb's Law; Electric current; resistance; electric circuits and Ohms Law. Kirchhoff's current and voltage Law, Power and energy, AC and DC, Introduction to Magnetism. *Waves and Sound:* Types of Waves; Reflection and refraction; Doppler effect; Interference; Nature of sound; Propagation of sound. *Optics:* Reflection; Mirrors; Diffraction interference; Polarization; Refraction; Lenses and images. *Nuclear Physics:* The nucleus; Radioactivity; Alpha; beta; and gamma decay; Half-lives.

FCH 1240: Foundation Chemistry1 [credits 12]
The course aims to develop a broader knowledge and scope of the concept of Chemistry, as well as improve the students' understanding while promoting creativity. The course aims to equip students with a better foundational level of Chemistry for entry into the mainstream. The pre-requisite for this course is that students must have successfully completed the first semester Chemistry module. The course engages the students to develop a more in-depth level of Chemistry as compared to what was taught during the first semester. The following content is covered during this second semester module: Phases of matter; with regards to the various states; physical and chemical properties and the classification of matter will be taught. Reaction rates (the various factors which affect reaction rates and Le Chatelier's Principle and its applications) and chemical and solubility equilibrium will follow. Thereafter, a more in-depth version of reduction–oxidation reactions and electrochemical cells will be dealt with compared to what was taught at the Grade 12 level. The next chapter deals with acids and bases, the properties; acid-base models; ionization of water and the pH and pOH scales and lastly volumetric analysis using acid-base titration methods. The final chapter includes the introduction of Organic Chemistry, i.e. the general properties and importance thereof; classification of organic compounds; and finally, students are taught how to name and draw organic compounds with their various functional groups.

FBI 1240: Foundation Biology 1 [credits 12]
The module introduces students to the substances that are biologically important, types of food they can consume for them to get the biologically important substances. Students will engage in the differentiation of different types of food stuffs following the types of compounds they contain. Students will also be familiarized with all the steps followed when one is conducting a scientific research.

SECTION 11:

DEPARTMENT: URBAN AND REGIONALPLANNING [URP]

11.1. QUALIFICATIONS OFFERED BY THE DEPARTMENT OF URP

BSc degrees (BSc):

- Bachelor of Science (Urban and Regional Planning) CODE: ESBURP

MSc degrees (MSc):

- Master (Urban and Regional Planning) CODE: ESMURP

PhD degrees (PhD):

- Doctor of Philosophy (Urban and Regional Planning) CODE: ESPDURP

11.2. BACHELOR OF SCIENCE QUALIFICATION (BSc) OFFERED BY THE DEPARTMENT OF URP

11.2.1. ADMISSION REQUIREMENTS

ADMISSIONS REQUIREMENTS	(a) Bachelor of Urban and Regional Planning requires Matric passes at symbol E (HG) or D=50% (SG) or 50% pass in NSC in Mathematics and 60% in English and four of the following matric subjects at symbol D=50% (HG) or C=60% (SG) or 60% pass in NSC in: Accounting; Agricultural Sciences; Biology or Life sciences; Economics; Geography; Physical Science; or Technical Drawing.

11.2.2. RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) A student may only progress to the second-year level when she/he has passed 60% of the 1st year modules in the mainstream BURP degree (b) To progress to the third-year level, a student must have passed **ALL** first- and second-year modules. (c) Students can register **ONLY** for modules for which **ALL** pre-requisites have been satisfied**.** (d) Students retain credits for all modules passed. (e) To obtain a BURP degree, students must have earned at least 480 credits including all core and fundamental modules, and the mini-dissertation. (f) The Department may prescribe additional credits **provided these do not exceed** the maximum credits. (g) The minimum registration period for a BURP degree is four years.
ASSESSMENT CRITERIA	(a) Continuous Assessment will consist of tests, practical, tutorials, projects, assignments, and reports. (b) Students will write examinations at the end of each semester on condition that they qualify to do so. (c) The minimum final pass mark in any module is 50%. (d) To obtain the degree *cum laude*, a candidate must attain an aggregate of 75% or higher in all moduels.

11.2.3. BSc DEGREE LEARNING STREAMS OFFERED IN THE DEPARTMENT OF URP [CREDITS = 480]:

Bachelor of Science (Urban and Regional Planning) **[CODE: ESBURP]**

Year 1 - NQF Level 5		Year 2 - NQF Level 6		Year 3 - NQF level 7		Year 4 - NQF level 8	
Core Modules							
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**		
URP 1141 (8) Intr. to Society and Planning **URP 1140** (8) Studio1 **ERM 1141** (8) The Natural Environment as System **ECS 1141** (8) English Com Skills	**URP 1241** (8) Principles & Techniques of Planning **URP 1240** (8) Studio 2 **MAT 1249** (8) Mathematics for Planners **ERM 1241** (8) Ecological Principles for Environmental Management **ECS 1246** (8) English Com Skills	**URP 2142** (12) Settlement forms & Urban History **URP 2143** (12) Intro. to Urban Planning **URP 2144** (12) Site Planning & Design (studio) **ERM 2141** (12) Principles of Resource Management	**URP 2241** (12) Rural Settlement Planning **URP 2243** (12) Quantitative methods in planning **URP 2244** (12) Planning for Infrastructure Development (Studio) **URP 2245** (12) Computers in planning(studio) **ERM 2241** (12) Pollution & Environmental Quality	**URP 3144** (14) Land - Use Planning & Development Management **URP 3145** (14) Planning theories & philosophy **URP 3146** (14) Urban design (studio) **URP 3148** (14) Spatial planning (Studio)	**URP 3244** (14) Planning law **URP 3245** (14) GIS in Planning (Studio) **URP 3246** (14) Research Methods for Planners **URP 3247** (14) Transportation Planning **URP 3248** (14) Regional development planning	**URP 4740** (32) Dissertation & Research Project **URP 4541**(14) Integrated Development Planning (Studio) **URP 4542** (14) Professional Planning Practice & Ethics **URP 4544** (14) Theories & Discourses in Urban & Regional Planning	**URP 4644** (14) Housing Studio **URP 4648** (14) Participation, Mediation & Conflict Resolution
Elective Modules – 16 credits taken from:		**Elective Modules – 20 credits taken from:**				**Elective Modules – 28 credits taken from**	
GEO 1120 (8) Intro. to cartography, map analysis & aerial photograph interpretation **SOC 1141** (8) Sociology **PAD 1141** (8) Public Administration **ECO 1141** (8) Economic Principles	**GEO 1220** (8) Elements of Remote Sensing & Geomatics **SOC 1241** (12) Sociology **PAD 1241** (8) Public Administration **ECO 1241** (8) Basic Economics	**ECO 2141** (10) Intermediate Macroeconomic Theory **PAD 2141** (10) Public Administration **SOC 2141** (10) Sociology **GEO 2141** (10) Spatial Organization of Society	**ECO 2241** (10) Financial economics **PAD 2241** (10) Public Administration **SOC 2241** (10) Sociology **GEO 2241** (10) Patterns & processes in Physical Geography			**URP 4543** (14) Transportation & Energy Planning **URP 4545** (14) Local, Socia and Economic Development **URP 4546** (14) Project Design & Management	**URP 4641** (14) Case Studies in Sustainable Settlement Planning **URP 4642** (14) Key Issues in Contemporary Planning **URP 4647** (14) Planning Small & Medium Sized Towns
Total: 13 modules Total credits = 96		**Total: 11 modules Total credits = 128**		**Total: 09 modules Total credits = 126**		**Total: 08 modules Total credits = 130**	

11.2.4. DESCRIPTION OF UNDERGRADUATE MODULES OFFERED BY THE DEPARTMENT OF URP

URP1140 : Studio 1 [Credits 8]
Module Content : Introduction to technical drawing, Architectural and Engineering skills, Design instruments and papers, drawing pencil, pen, board, set square, scale ruler, Cartridge A3, A2, A1, A0, free hand lettering, size and scale, geometric construction, ellipse, arch. Orthographic projection, first and third angle projection, Isometric projection, section and hatching, hexagon, sectional drawing of assembly, assembly drawing and detail drawings

URP1240 : Studio 2 [Credits 8]
Module Content : Art of site planning, defining the problem, site planning process, site analysis, schematic design, detail costing, developed design, contract documents, bidding and contracting, construction, occupation and management. Coverage setback, dimension lines, colour (plan or section), letter symbols, locality, key and site plan, floor plan, foundation plan, elevations, sections, roof plan, door, window schedule and development.

URP1141 : Introduction to Society and Planning [Credits 8]
Module Content : Meaning of planning, planning typologies and related disciplines. Basic sociological concepts; cultural norms and values. Social change and development. Human settlement; people, resources and networks. Urbanization; definitions and conceptualization, urban development in Southern Africa. The planner and society, urban and regional development theories. Understanding planning as asocial and political process. Planners and Plans, Planner as technocrat, advocate, educator, co-coordinator, mediator and social scientist. Participation in the planning process. Planning responses to rural and rural conditions in Africa.

URP1241 : Principles & Techniques of Planning [Credits 8]
Module Content : Origins of planning, urbanization, economic development and the environment, urban/rural linkages. Urban trends, change and socio-political transformations. Evolution of planning principles, standards and concerns. Method of social, economic, and physical planning surveys, analytical and procedural techniques in the planning process. Quantitative, cartographic and planning graphics.

URP1249 : Mathematics for Planners [Credits 8]
Module Content : Basic Concepts in mensuration, trigonometry, geometry, liner and matrix algebra, population growth models. Descriptive statistic: sampling and collection of data, dispersion. Probability and inference and statistical distribution. Sampling frames, techniques, distributions. Estimation theory and hypothesis testing of sampling averages of average and proportions.

URP 2142 : Settlement forms & Urban History [Credits 12]
Prerequisite : *URP 1141*
Module Content : History of settlements and urban forms of influence of settlement design and planning in different socio-political economic and geographical contexts. Visions of Utopian cities and settlements patterns; treatment of public and private space and functional relationships between organization of space and social structure

URP 2143 : Introduction to Urban Planning [Credits 12]
Module Content : Historical contexts of urbanization (pre-industrial, industrial and post-industrial periods and planning concepts and practices derived there from. Theories of urban growth (Chicago ecological school) and the urban economy (urban land market). Utopian/ideal city. Garden Cities, New towns, neighborhood concepts, smart growth concept, regeneration and redevelopment. Controls versus facilitation. Integrated approach to development planning (IDP). Sustainable Planning.

URP 2241 : Rural Settlement Planning [Credits 12]
Module Content : the scope of regional and rural planning. History of regional planning in developed and developing economies. Theoretical bases for regional and rural development. Regional planning strategies in Africa and SADC: growth centres and points, rural services centres river basin management, SDI, ISRDPs. Theories of land use in land use planning and development. Urban land economic and markets, property markets, Planning issues and activities related to economics and financing of public and private projects. Land service and delivery systems. How planning interventions or (lack thereof) influence land markets and economics. Processes in the zone of transition (densification and internal re-organization) and rural-urban fringe. IDP, empowerment.

URP 2144 : Site Planning & Design (Studio) [Credits 12]
Prerequisite : *URP 1240*
Module Content : Principles of land surveys in preparation for land development, site selection and planning, layout design and development. Site analysis, base maps preparation and deriving site standards and design criteria

for various land uses. Preparation of detailed site plans, taking into account cultural aesthetic, climatic, economic, physical, social and infrastructural factors which influence planning and the design process.

URP 2244 : Planning for Infrastructure Development (Studio) [Credits 12]
Prerequisite : *URP 2144*
Module Content : Deriving design criteria and standards for the provision of basic physical and line infrastructure for different land use configurations and densities i.e., free-hand and automated design. This includes aspect of municipal engineering in relation to supply, reticulation and maintenance of water, storm-water drainage, electricity, sewage and roads.

URP 2243 : Quantitative Methods in Planning [Credits 12]
Prerequisite : *MAT 1249*
Module Content : Review of probability and descriptive statistics. Types and sources of basic planning data; Forecasting models in planning: continuous and discontinuous functions applied to planning forecast, population projection techniques, Cohort survival and other techniques, gravity and migration models. Practical uses and application of spreadsheets and statistical packages; testing of significance for multiple samples using nominal, ordinal and ration scale samples.

URP2245 : Computers in Planning (Studio) [Credits 12]
Module Content : Planning data base concepts: structure creating data bases, data entry and editing. Importing data-base from other applications. Spread sheet basics, making tables and graphic (Excel, SPSS). Adding pictures and to texts. Computer-based techniques for mapping and analysis of spatial data (GIS). CAD applications in Planning. Planning projects.

URP 3544 : Land Use Planning & Development Management [Credits 14]
Module Content : Land as a resource; land use types, land tenure, land classification. Theoretical underpinnings of land use planning, land value, accessibility, competition, environmental quality. Land Use surveys, Land fragmentation, Consolidation, space usage, Planning standards and principles of layout planning, Land use policies and controls, Problems of Land Redevelopment. Areas of land use conflict; the inner-city zone of transition and rural urban fringe. Problems of urban sprawl and reconstructing the apartheid settlements forms.

URP 3644 : Planning Law [Credits 14]
Module Content : Planning laws and the legitimacy of planning activity. Values and the normative nature of planning legislation; ideologies of planning law. The legacy of apartheid spatial legislation; emerging statutory framework and processes for planning in South Africa: The development Facilitation Act, Municipal Systems Act, Wise land use Bill and those relating to transport, environment, land reform and water. Development control, development management and facilitation in South Africa, concepts, tools; the planning process. Principles and sub-principles for land development. Principles for decision making and conflict resolution.

URP 3545 : Planning Theory & Philosophy [Credits 14]
Prerequisite : URP 2143
Module Content : Theories in planning and of planning, classification of planning theories (explanatory, substantive and procedural etc.). Examination of planning theory and intellectual contributions to planning thought and implementation. Analysis of economic, political, legal and institutional contexts within which particular planning theories are conceived.

URP 3645 : GIS in Planning (Studio) [Credits 14]
Prerequisite : *URP 2245*
Module Content : Introduction-overview and definition, GI data characteristics, IS components, data sources, IS an integration technology, IS versus CAD; GIS data structures-spatial data modeling, raster structure-characteristics, zone, value, location, vector data structure-nodes, arc, polygons, raster versus vector; Data Acquisition and Input- Overview of GIS data sources, Ground based data acquisition approaches-space borne, characteristics of each, examples of existing missions, maps, data inputs- different data inputs modes, map digitizing, point versus stream mode, digitizing problems, editing, edge matching, scanning; Data management systems-data base concepts, spatial databases, relational databases, ER modeling, Duplication and redundancy, cardinality ratios, obligatory and non-obligatory, 1:1 and 1: M relationships, Normalization; GIS analysis and reporting- retrieval, classification, measurement procedures, map calculations, overlays, neighborhood operations, data options; Application areas- rural resource planning and management, urban planning and management, Utility management, resource monitoring, environment impact assessment; trends in GIS-data standards, sharing, distributed GIS, legal issues

URP 3546 : Urban Design (Studio) [Credits 14]
Prerequisite : *URP 2244*
Module Content : Intensive studio, addressing both new and redevelopment planning design at community and higher scale. A problem-based exploration involving studio seminars, consultation and critiques that integrate design elements that provide socially viable and economically sustainable communities with a sense of place.

URP 3646 : Research Methods for Planners [Credits 14]
Prerequisite : *URP 2243*
Module content : Provision of an understanding of approaches to qualitative and quantitative research methods in the social sciences and in particular planning. Logic of social research methods related to planning and including analysis of demographic economic, economic land use and transportation data. Approaches to research design, proposal writing, setting of goals, objectives and research hypothesis and design methodology. Techniques of data collection, analysis and presentation; Review of research instruments, interviews, questionnaire preparation, coding and administration; land use surveys. Library research essay writing. Presentation techniques.

URP 3647 : Transportation Planning [Credits 14]
Module content : Overview of transport planning, transport as derived demand, comprehensive transportation planning, transport modes and units of carriage, transport and movement of goods, transport economics, transport logistics and distribution management, integrating land use and transportation planning, route and network planning and analysis, transport corridor development, transportation studies and surveys, origin-destination surveys, transport demand surveys, transport modal split survey and analysis, traffic and road condition surveys, road design and improvement traffic audits, traffic accidents and traffic calming and management strategies, traffic engineering and planning, transport and demand management strategies, current transportation planning challenges-rural travel and transportation, transport and HIV/AIDS, transport and the disabled, Transport R & D, and transport S & T issues, Labor based technology.

URP 3648 : Development Planning Studio [Credits 14]
Module Content : To provide learners with the fundamental concepts, principles and applications of regional development planning in the context of the built and non-built environment development and sustainability. The module will expose learners to cutting-edge regional development planning theories and models/applications necessary to promote the creation of vibrant and sustainable settlements available to urban and regional planning scientists and practitioners today and provide students with hands-on experience that will assist them in meeting future challenges in built and non-built environment field/sector. The course introduces learners to the use and application of regional development planning principles in structuring and restructuring rural settlements as an important aspect of change management within the development cycle.

URP 3548 : Spatial Planning [Credits 14]
Module Content : Overview of spatial planning, role of spatial planning in development planning and management, professions in spatial planning, types and hierarchy of spatial plans, physical plans, regional/provincial plans, master plans, structure plans, local plans, subject, development and redevelopment plans, layout plans, neighborhood plans, spatial planning data and information requirements, techniques, techniques and methods in spatial planning, spatial planning information systems, spatial planning analysis and presentation techniques and methods, spatial planning processes, systems and institutions, spatial planning legislation specifications and requirements (spatial planning and planning law), spatial planning regulation, development control, development facilitation and development administration, spatial planning and contemporary planning challenges- environmental sustainability, poverty reduction, empowerment etc., the future of spatial planning.

URP4740/5740 : Dissertation/Supervised Research Project [Credits 32]
Prerequisite : URP 3646
Module Content : Project Identification; proposal writing, problem identification; theoretical framework; project objectives; project methodology; field reconnaissance. Information gathering; primary and secondary data; surveys of people and objects; preliminary analysis; classification and forecasting. Modules; predictive and evaluative. Plan Design. Evaluation partial evaluation techniques; financial appraisal; cost effectiveness analysis. Dissertation writing and submission.

URP 4541 : Integrated Development Planning (Studio) [Credits 14]
Prerequisite : URP 3548
Module Content : Approaches to integrated development planning. Characteristics and objectives of IDP and effectiveness as articulated within the South African context. Strategies for linking key sectors such as employment, land use, transportation, local economic development (LED) and environment. Overview of the unique planning and development dimensions of small communities in/and rural regions. Role of small towns in development; typologies of small towns: (resource frontier towns, limited resource bases, etc). Local economic

development/facilitation in small towns; strategies for small town regeneration and sustainable growth and development, institutional arrangements for LED in SA. Urban redevelopment and ISRDP as local level IDP.

URP 4542/5542: Professional Planning Practice and Ethics [Credits 14]
Prerequisite : URP 3544
Module Content **:** The course examines the practice and theory aspects of current concern to the planning profession. It examines the evolution of the planning profession, the concept of professionalism, professional ethics; practice in both public and public sectors. Running a professional planning office: budgeting, staffing & tendering, responsibility to the public, to the profession, to client, the employer and the social sciences. The emerging statutory, administrative and institutional framework for land development and management; role of central provincial and local government; planning commissions and development tribunals. Public participation; EIA. Role of the planner (manager/facilitator/advocate). The evolving development planning framework.

URP 4663/5543: Transportation & Energy Planning [Credits 14]
Module Content **:** Sources of energy, renewal and non-renewable energy; conservation and management strategies of renewable and non-renewable resources. Impacts of energy (and planning) on the environment, land use, transportation, socio-economy, political and life styles, ozone depletion; global warming. Energy waste, Solid and toxic waste. EIA in the energy and transportation sectors. Basic principles and techniques in the planning and management of public transportation systems. Data requirements in transportation planning; evaluation of transportation alternatives and the decision-making process. Travel demand and supply analysis (trip generation, distribution, assignment and modal split). Cost and capacity relationship of all modes; relationship between land use and transportation. Rural transport systems.

URP 4544/5544: Discourses in Urban & Regional Planning Theory [Credits 14]
Prerequisite : URP 3545
Module Content **:** Review of intellectual and political underpinnings of contemporary planning theories. Paradigm epochal shifts in planning research and practice. Modernist versus postmodernist/ post- Fordism; new frontiers/ debates in planning. Is there any need for theory in planning- the theory/practice chasm/ nexus. Academics/ Practitioners? Ideology and planning. How have regional theories influences regional development practices and regional development. Theoretical underpinnings of selected regional planning/development strategies (development nodes, ISRDPs, growth centre policy, SDIs, IDZ, river basin management, decentralization, trans-frontier parks etc.). Evaluation of institutional and jurisdictional setting for regional planning (SACU, SADC, NEPAD, ECOWAS, EC, NAFTA, etc.). The future of regional planning.

URP 4642/5642 : Case Studies in Sustainable Settlement Planning [Credits 14]
Module Content : Concepts of sustainable development and sustainable settlement planning; priorities for development, conditions for sustainable development (economic, ecology etc.). Creating sustainable livelihood and implications for political ecology and economy for resource allocation. Sustainable cities case studies. SMART CITIES AND NEW URBANISM. Urban renewal and regeneration, cluster development and place marketing. Principles for creating sustainable places, operational principles for sustainable development; restoration ecology. Best case studies. Tourism, the tourism industry. The essential components of econ-tourism, natural base, infrastructure, economic relationships. Reconciling human and wildlife/parks conflicts; community-based initiatives. Laws of conservation of endangered and threatened species and ecosystems. Traditional/cultural properties. Heritage landscapes types; traditional cultural values in preservation planning, IKS; procedures for national register nomination; consideration, documentation, protection and monitoring of heritage sites.

URP 4642/5642: Key Issues in Contemporary Planning [Credits 14]
Module Content : Planning as mediation, arbitration and resolution of conflicts in resource allocation and usage. Levels of participation, (including Arnsteins ladder of planning participation). Techniques of and case studies in participation, mediation and conflict resolution. Gender: concept definitions; History of gender issues; local and international. Concept of gender and development. Gender analytical tools and framework. Empowerment framework: information, access, participation, control, culturally determined gender roles and environmental conservation in selected parts of the world. Examination and comparative analysis of specific planning themes and issues (development management, informal housing and employment, urban sprawl, rural land use, planning institutions, change of land in SADC countries. EIA as a management tool, basic concepts, preliminary activities, impact identification (scoping); baseline study; impact evaluation (quantification); mitigation measures; assessment; documentation; decision making; post auditing; falsehoods surrounding EIA, problems and solution of EIA; institutional arrangements.

URP4546/5546 : Project Design & Management [Credits: 14]
Module Content : Project identification and principles of project design implementation monitoring and feedback. Preparing an offer of service and reinterpretation of client's mandates, tendering procedures for projects, Pre-qualification, costing of projects. Creating demand, client relations, and professional ethics. Designing a project, dos and don'ts. Contract administration and financial procedures, penalties, retention and insurance.

URP4644/5644 : Housing Studio [Credits 14]
Prerequisite : URP 3546
Module Content **:** Theory of Housing; evolution of housing prototypes. Housing and land use in rural and urban areas. Formal and informal housing; shelter and poverty. Housing delivery systems. Housing quality and affordability. Land tenure systems. Housing policies and Strategies; the urban housing market. Interaction between informal and formal of housing supply. The myth of home-ownership and the reality of housing tenancy. Urban housing development and design processes.

URP 4565/5565: Local Economic Development [Credits: 14]
Module Content **:** Overview of LED, evolution of LED, globalization and local economic development, principles and concepts in LED, empowerment, indigenization, technology and skill transfer, Gender- GID (gender in development) and GAD (gender and development)., disability and planning, participation, Governance and Institutions, Micro Enterprises and financing mechanisms, indigenous technical knowledge, technology and the environment. Farmer-based innovations in agriculture; African case studies. Blending appropriate technology with farmer indigenous knowledge. Concepts of technology; socio-economic and environmental impacts of technology. Appropriate technology; intermediate technologies, political issues of technology and the environment. Applications and impacts of modern technology in environmental management. Integrating LED in Spatial development initiatives, spatial development plans, IRDSP, Spatial planning, strategic Planning etc.

URP 4667 : Planning Small Towns [Credits 14]
Module Content **:** Overview of planning in small towns, the planning process and the mini-town, determining small town goals and objectives, information, data and resources for the mini-plan, transportation and circulation in small towns, natural environment, community preservation and restoration, the role of small towns in development, links with rural and regional development, types of small, resource frontier towns, limited resource bases, design and appearance of small towns, putting the small town plan into action, development facilitation and local economic development in small towns, strategies for small town development, strategic for the future of small towns.

URP 4668 : Modes of Participation, Mediation and Conflict Resolution [Credits 14]
Prerequisite : URP 3547
Module Content : Overview of participation, mediation and conflict resolution, participation, mediation and conflict resolution guiding principles and specification, planning as mediation, arbitration and resolution of conflicts in resource allocation and usage. Consultation and participation. Who gains and who loses. Levels of participations. Ladder and Hierarchy of planning participation, mediation and resolution, participatory mapping and modeling, transact analysis, trends and time lines, seasonal calendars, matrix ranking and scoring, livelihoods analysis, wealth and wellbeing ranking, Venn diagramming and semi structured interviewing. Skills and techniques for facilitating group dynamics, functional PRA teams, establishment of rapport Participatory Project Planning: Community ACTION Plans. Case studies of participation in action- participation in housing and infrastructure development, Participation in urban design and planning, participation in rural resources planning and management, participation in mobility and accessibility planning etc. Challenges and issues in participation, mediation and conflict resolution.

11.4. MASTERS QUALIFICATIONS OFFERED IN THE DEPARTMENT OF URP ARE ONLY BY RESEARCH

11.4.1 ADMISSION REQUIREMENTS

Qualification	Qualification Code	Duration	Admission Requirements
Masters (Urban and Regional Planning)	ESMURP	2 years	(a) A 4 years BSc or BSc Honours in Urban and Regional Planning, Geography, and/or Environmental Science, or other related fields of study in the Natural or Physical Sciences with an average of 65%, an upper - second class for a class -based systems with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4 -point scale system or a 3.1 for a 5 -point scale OR equivalent status conferred by SENATE. (b) An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. (c) Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

11.4.2. RULES FOR PROGRESSION AND ASSESSMENT CRITERIA

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title and topic of the proposed dissertation, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and the Faculty Higher Degrees Committee final approval. (b) The Research proposal, registration and ethics must be approved by the Deprtments Higher Degrees Committee and then send for final approval to the Faculty Higher Degrees Committee and UHDC. (c) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the Master's degree may be conferred only after the candidate has been registered for a period of at least TWO years fulltime. (d) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE. (e) The Research MSc degree is conferred based on a dissertation and an examination, or a dissertation only, as determined by the Faculty Academic Board. (f) The taught MSc degree is conferred based on a mini dissertation and a component of taught modules which must all be passed as per degree requirements (g) The Head of Department may prescribe certain ancillary modules which must be enrolled or passed before the date of the Master's examination. (h) The general rules of the University will apply, **unless** otherwise specified for the Faculty of Science, Engineering and Agriculture. (i) SENATE may, at any time, suspend or cancel the registration of any student who, in its view, is not making satisfactory progress. (j) Students who wish to defer their studies at **any stage MUST APPLY** to the relevant department. If granted, such deferment will be for **a maximum period of one year**, after which a further application must be submitted. Deferment will, **at most**, be granted twice. (k) Before registration for 2nd or further years, the student must write a full progress report for the year passed which is signed by the supervisor and the HOD to show progress, which will be approved /not approved by the Executive Dean. This progress report will count as the last quarterly report of the passed year for the student. **No** student will be allowed to register without the approval of the Executive Dean
ASSESSMENT CRITERIA	(a) Procedures as per post-graduate policies and guidelines will be followed – this includes the agreement between the student and supervisor that must be in placed as well as the quarterly reports that must be send to the Faculty Research office as proof of student's progress (b) Quarterly progress reports are compulsory

11.5. DOCTORAL QUALIFICATIONS OFFERED BY THE DEPARTMENT OF URP

11.5.1. ADMISSION REQUIREMENTS

Qualification	Qualification Code	Duration	Admission Requirements
PhD (Urban and Regional Planning)	ESPDURP	3 years	(a) A Masters in Urban and Regional Planning/Architecture with a minimum mark of 65% OR equivalent status conferred by SENATE. (b) An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions. (c) Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates should have registered with SACPLAN or other planning bodies for RPL to demonstrate commitment to the planning profession Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

12.5.2. RULES FOR PROGRESSION

RULES FOR PROGRESSION	(a) Before a candidate's application for registration can be considered, the title and topic of the proposed thesis, together with a brief outline of the research must be submitted, signed by the supervisor, to the department Higher Degrees Committee and then the Faculty Higher Degrees Committee for approval. (b) The Research proposal, registration of project and ethics application must be approved by the Departments and Faculty's Higher Degrees Committee before final approval by the UHDC.

	(c) Unless otherwise decided by SENATE and subject to special provisions in the Faculty, the degree may be conferred only after the candidate has been registered for a period of at least THREE years fulltime. (d) Extension may be granted only in exceptional cases and for only ONE year. A student who desires an extension must submit a motivated application for consideration by SENATE.
ASSESSMENT CRITERIA	(a) Procedures as per Postgraduate policy guidelines will be followed. This will include the agreement between the supervisor and the doctoral student and the quarterly progress reports that must be submitted in time to the Faculty Research office (b) External examination of thesis will be done as per Post Graduate policies (c) Viva Voce as per school postgraduate guidelines through the office of the Executive Dean. If a student fails the Viva Voce, the degree will not be awarded. (d) Quarterly progress reports are compulsory

SECTION 12:

AGRICULTURAL SCIENCES

S.1 DEGREES / DIPLOMAS CONFERRED - ALL UNDERGRADUATE DEGREE PROGRAMMES ARE AT NQF LEVEL 8.

Bachelor of Science in Agriculture:	
- Agricultural Economics specialization	AGBAAE
- Agribusiness Management specialization	AGBAAM
- Animal Science specialization	AGBAAS
- Horticultural Science specialization	AGBAHS
- Plant Production specialization	AGBAPP
- Soil Science specialization	AGBASS
Bachelor of Science in Food Science and Technology	**AGBFST**
Bachelor of Science in Forestry	**AGBBFR**
Bachelor of Science in Agricultural and Biosystems Engineering	**BSC(ENG)**
Bachelor of Arts Honours in Rural Development	**AGHHRD**
Master of Science in Agriculture:	
- Agricultural Economics specialization	AGMAAE
- Agricultural Mechanization specialization	AGMARE
- Animal Science specialization	AGMAAS
- Horticultural Science specialization	AGMAHS
- Plant Production specialization	AGMAPP
- Soil Science specialization	AGMASS
Master of Science in Food Science and Technology	**AGMFST**
Master of Arts in Rural Development	**AGMARD**
Doctor of Philosophy	
- Agricultural Economics specialization	AGPAAE
- Animal Science specialization	AGPAAS
- Crop Science specialization	AGPACS
- Food Science and Technology specialization	AGPFST
- Horticultural Science specialization	AGPHCS
- Rural Development specialization	AGPPRD
- Soil Science specialization	AGPASS

S. 2 ADMISSION REQUIREMENTS

2.1 GENERAL ADMISSION REQUIREMENTS

2.1.1 The minimum admission requirement for a candidate wishing to enroll for the degree program is a National Senior Certificate (NSC) or Independent Examination Board (IEB) school leaving certificate as certified by Council for Quality Assurance in General and Further Education (Umalusi) with a minimum achievement rating of 4 (adequate achievement, 50-59%) in Mathematics and Physical Science, English and either Life Sciences or Agricultural Sciences. **In addition, applicants must have a minimum admission point score (APS) of 26 (subject to review by Senate from time to time).** A grade 12 certificate with a bachelor's degree or matric exemption if grade 12 was completed before 2008.

2.1.2 Candidates may be admitted based on recognition of prior learning (RPL). Individuals will be declared competent based on the provisions of the recognition of prior learning policy of UNIVEN.

Note: Achievement of the minimum admission requirements does not guarantee an applicant admission to any Programme.

Calculation of admission point score

MATRIC	NSC LEVEL	PERCENTAGE	SCORE
A+	7	90 - 100	9.0 - 10
A	7	80 - 89	8.0 - 8.9
B	6	70 -79	7.0 - 7.9
C	5	60 - 69	6.0 - 6.9
D	4	50 - 59	5.0 - 5.9
E	3	40 - 49	4.0 - 4.9

Life Orientation and Mathematics Literacy is not included in the calculation of APS.

2.2 BACHELOR'S DEGREE - SPECIFIC ADMISSION REQUIREMENTS

2.2.1 BACHELOR OF SCIENCE IN AGRICULTURE (AGBAAE; AGBAAM; AGBAAS; AGBAHS; AGBAPP and AGBASS)

2.2.1.1 The minimum admission requirement for a candidate wishing to enroll for the degree program is a National Senior Certificate (NSC) with a bachelor's endorsement or Independent Examination Board (IEB) school leaving certificate as certified by Council for Quality Assurance in General and Further Education (Umalusi). **A pass with a minimum achievement rating of 4 (50-59%) in Mathematics and Physical Science, English and either Life Sciences or Agricultural Sciences is required to enroll for the programme. In addition, applicants must have a minimum point score of 26.**

2.2.2. BACHELOR OF SCIENCE IN FORESTRY (AGBBFR)

2.2.2.1 The admission requirements are the same as for the Bachelor of Science in Agriculture above.

2.2.3. BACHELOR OF SCIENCE IN FOOD SCIENCE & TECHNOLOGY (AGBFST)

2.2.3.1 The minimum admission requirement for a candidate wishing to enroll for the degree program is a National Senior Certificate (NSC) with a bachelors' endorsement or Independent Examination Board (IEB) school leaving certificate as certified by Council for Quality Assurance in General and Further Education (Umalusi). **A pass with a minimum achievement rating of 5 (60-69%) in Mathematics and Physical Science, achievement rating of 4 (50-59%) in English and either Life Sciences or Agricultural Sciences is required to enroll for the programme. In addition, applicants must have a minimum point score of 32.**

2.2.4 BACHELOR OF SCIENCE IN AGRICULTURAL AND BIOSYTEMS ENGINEERING (BSCENG)

2.2.4.1 The minimum admission requirement for a candidate wishing to enroll for the degree program is a National Senior Certificate (NSC) with a bachelors' endorsement or Independent Examination Board (IEB) School Leaving Certificate as certified by Council for Quality Assurance in General and Further Education (Umalusi). **A pass with a minimum achievement rating of 6 (70-79%) in Mathematics, Physical Science, Life Sciences or Agricultural Sciences and a minimum achievement rating of 4 (50-59%) in English is required to enroll for the programme. In addition, applicants must have a minimum point score of 32.**

2.2.5 BACHELOR OF ARTS HONOURS IN RURAL DEVELOPMENT (AGHHRD)

2.2.5.1 To qualify for admission, a student must possess a Bachelor degree with an average of 60% pass in the field of specialization.

2.2.5.2 Minimum qualification for admission is an undergraduate degree in Agriculture (B. Agric or BSc. Agric), BA or BSc in Sociology, Anthropology, Development Studies, Community Development, Environmental

Sciences, Education, B.Com in Economics, Management or any other related discipline, from this or any other university, as may be determined by the Director of the Centre.

2.2.5.3 Recognition of Prior Learning of practitioners in line with the University policy.

2.3. MASTERS DEGREE-SPECIFIC ADMISSION REQUIREMENTS

2.3.1 MASTER OF SCIENCE IN AGRICULTURE IN AGRICULTURAL ECONOMICS

2.3.1.1. A relevant 4 years Bachelor degree or Honours degree with an average of 65%, an upper-second class for a class-based systems with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE.

2.3.1.2. An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions.

2.3.1.3. Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

2.3.2. MASTER OF SCIENCE IN AGRICULTURE IN AGRICULTURAL MECHANIZATION

2.3.2.1. A relevant 4 years Bachelor degree or Honours degree with an average of 65%, an upper-second class for a class-based systems with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE.

2.3.2.2. An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions.

2.3.2.3. Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

2.3.3. MASTER OF SCIENCE IN AGRICULTURE IN ANIMAL SCIENCE

2.3.3.1 A relevant 4 year Bachelor degree or Honours degree with a minimum weighted average pass mark of 65% across the undergraduate curriculum, **weighted/calculated** as follows: (1x0.10) + (2x 0.20) + (3x0.40) + (4x0.30)

2.2.3.2. A minimum 65% final mark for the Research Project at the Honours or equivalent level.

2.2.3.3. An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions.

2.3.3.4. Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

2.3.4. MASTER OF SCIENCE IN AGRICULTURE IN SOIL SCIENCE, HORTICULTURAL SCIENCE AND PLANT PRODUCTION

2.3.4.1. A 4 years BSc or BSc Honours in Agriculture, Horticulture, Soil Science, Environmental Sciences, Forestry or related plant and soil sciences field of specialization with an average of 65%, an upper-second class for a class-based systems with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE.

2.3.4.2. A minimum 65% final mark for the fourth year or Hons Research Project.

2.3.4.3. An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions.

2.3.4.4. Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

2.3.5. MASTER OF SCIENCE IN FOOD SCIENCE AND TECHNOLOGY

2.3.5.1. A 4 year BSc in Food Science and Technology, BSc Honours in Food Science or Food Technology, BTech in Food Technology, Postgraduate Diploma in Food Technology with an average of 65%, an upper-second class for a class-based systems with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE.

2.3.5.2. An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions.

2.3.5.3. Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

2.3.6. MASTER OF ARTS IN RURAL DEVELOPMENT

2.3.6.1. A relevant 4 years Bachelor degree or Honours degree with an average of 65%, an upper-second class for a class-based systems with a minimum mark of 65 %, or a Grading Point Average (GPA) of 2.6 (65 % of 4) on a 4-point scale system or a 3.1 for a 5-point scale OR equivalent status conferred by SENATE.

2.3.6.2. An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions.

2.3.6.3. Candidates who do not meet the minimum admission requirements may be considered by the IRD Board for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as a selection test, a portfolio of evidence, submission of a concept paper, an interview by a selection panel constituted by the IRD Board. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

2.4. DOCTOR OF PHILOSOPHY DEGREE-SPECIFIC ADMISSION REQUIREMENTS

2.4.1. PhD IN AGRICULTURE IN AGRICULTURAL ECONOMICS

2.4.1.1. A MSc in Agricultural Economics with a minimum mark of 65% OR equivalent status conferred by SENATE.

2.4.1.2. An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions.

2.4.1.3. Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

2.4.2. PhD IN AGRICULTURE IN ANIMAL SCIENCE

2.4.2.1. A MSc in Agriculture (Animal Science) with a minimum mark of 65% OR equivalent status conferred by SENATE.

2.4.2.2. An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions.

2.4.2.3. Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

2.4.3. PhD IN AGRICULTURE IN SOIL SCIENCE, HORTICULTURAL SCIENCE AND CROP SCIENCE

2.4.3.1. A Master of Science in Agriculture, Master of Science in Agriculture: Soil Science/Horticultural Sciences/Crop Sciences, with a minimum mark of 65% OR equivalent status conferred by SENATE.

2.4.3.2. An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions.

2.4.3.3. Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN

2.4.4. PhD IN FOOD SCIENCE AND TECHNOLOGY

2.4.4.1. A MSc in Food Science and/or Food Technology, MTech in Food Technology with a minimum mark of 65% OR equivalent status conferred by SENATE.

2.4.4.2. An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions.

2.4.4.3. Candidates who do not meet the minimum admission requirements may be considered by the Departmental Research Committee for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as submission and presentation of a concept paper, an interview by a selection panel constituted by Departmental Research Committee. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

2.4.5. PhD IN RURAL DEVELOPMENT

2.4.5.1. A Master of Arts in Rural Development with an average of 65% OR equivalent status conferred by SENATE.

2.4.5.2. An applicant who has obtained a degree at another university must apply for status recognition subject to the prescribed conditions.

2.4.5.3. Candidates who do not meet the minimum admission requirements may be considered by the IRD Board for admission through recognition of prior learning (RPL), including assessment for readiness using tools such as submission and presentation of a concept paper, an interview by a selection panel constituted by the IRD Board. Candidates will be declared competent based on the provisions of the RPL policy of UNIVEN.

S. 3 DURATION OF STUDY

3.1. The curriculum shall extend over a period of at least four years of full-time study for all the undergraduate / bachelors programmes offered by the school.

3.2. The minimum duration of study for the masters degree by research is one academic year. The maximum period of study is three years for full-time study and four years of part-time study. Students who wish to defer their studies at any stage must submit an application to the relevant department. If granted, such deferment will be for a maximum period of one year, after which a further application must be submitted. Deferment will, at most, be granted twice.

3.3. The duration of study for a doctoral degree will extend over a period of at least two years of full-time study and three years of part-time study. The maximum period of study is five years full-time and seven years part-time, subject to Senate approval. Extension may be granted only in exceptional cases and for only one year. A student who desires an extension must submit a motivated application for consideration by Senate.

S. 4 COMPOSITION OF THE CURRICULUM

4.1 BACHELOR OF SCIENCE IN AGRICULTURE (all specializations)

4.1.1 When the word "module" is used, it shall mean for a period of one semester except those ending with code …081.

4.1.2. Students may not select modules that clash on the lecturing and practical timetables. No modules, whether within the School or from outside the School will be recognized unless approved by the relevant Heads of Departments and the Dean of the School. Students wishing to enroll for **non-degree purpose (NDP) modules** must consult the Head of Department and the Executive Dean.

4.1.3. **Students are allowed to register only modules for which prerequisites have been passed**

4.1.4. A student who does not gain any credit in his/her first year of study will not be re-admitted to the same programme in the following year.

4.2 BACHELOR OF SCIENCE IN FORESTRY

4.2.1. Same as in 4.1

4.3 BACHELOR OF SCIENCE IN FOOD SCIENCE AND TECHNOLOGY

4.3.1. Same as in 4.1

4.4 MASTER OF SCIENCE IN AGRICULTURE, MASTER OF SCIENCE IN FOOD SCIENCE AND TECHNOLOGY and MASTERS IN RURAL DEVELOPMENT (Dissertation only)

4.4.1 The curriculum consists of a dissertation based on a topic recommended by the Head of Department as well as the school's Postgraduate Studies Committee for approval by Senate.

4.4.2 Students may be required to take some makeup/ancillary modules as may be determined by the Head of Department under which the student is specializing. The modules may be at undergraduate or honours level or both.

4.5 DOCTOR OF PHILOSOPHY IN AGRICULTURE and DOCTOR OF PHILOSOPHY IN RURAL DEVELOPMENT

4.5.1 The curriculum consists of a thesis based on a topic approved by the Head of the Department as well as the school's Postgraduate Studies Committee for approval by Senate.

S. 5 MODULE CREDITS

5.1 Students retain credits for all modules passed.

5.2 A candidate shall not be permitted to repeat a module more than once. In the case of a final year student, the rule may be waived at the discretion of the Dean in consultation with the Head of Department.

5.3 No student will be allowed to switch from one School to another without consulting the relevant Deans and Heads of Departments and without complying with the relevant School entrance requirements.

5.4 Senate, on the recommendation of the School, may cancel or refuse to renew the registration of any student whose academic record is regarded by the School to be so unsatisfactory that the degree will not be completed within the period as stipulated in the General Rules.

5.5 **In order to register second year modules, a student must pass 60% of first year modules. To register third year modules, all first year and second year modules must be passed while all modules at first, second and third years must be passed in order to register for the final year of study of a programme.**

5.6 To register for a module, the prerequisite module(s) must be passed where applicable.

S. 6 CREDIT FOR MODULES PASSED ELSEWHERE.

6.1 Accepted candidates may, subject to the provision of Rules S.4 and S.5 receive credit for modules completed at another recognized University towards a degree of this University, on application to the Senate.

6.2 Candidates holding a Diploma in Agriculture from a recognized Tertiary Institution may be exempted from certain modules on recommendation by the School and approval by Senate. For students who are granted exemption, there may be restrictions on the choice of disciplines.

S. 7 ASSESSMENT METHOD FOR DIPLOMA, BACHELOR'S AND HONOURS DEGREES

7.1 In the first 3 or 4 years of study of a bachelor's degree each module will be assessed thus:
Continuous assessment of content (60%) and Examinations of content (40%)

7.2 A student must acquire a minimum of 40% in each of the two components of assessment. To qualify for the examination a student must have obtained 40% in the continuous assessment (tests, assignments and projects).

7.3 Subject to the respective rules, candidates for postgraduate degrees will only be assessed in a particular module if they attended lectures, tutorials and prescribed practicals satisfactorily and obtained a semester mark of 50%.

7.4. Candidates are not entitled to their assessment results unless they have paid the prescribed fees.

7.5. A student must attain a minimum of 50% pass in each of the components of assessment. A student who fails one of these components, will be allowed to repeat only that component. The written examination component will be conducted during the next normal examination period for that specific module.

7.6 All written examinations will be taken only during official examination sessions.

7.6. A mini dissertation / research report for honours students will not exceed 60 pages. Progress must be kept by both the supervisor and the Head of department and a report must be produced every semester. This report must serve at the respective school boards through the School's Postgraduate Studies Committee at the end of every semester. Each school shall submit their reports to the Dean who will in turn submit these reports to Senate.

7.8. All examination reports will be approved by the respective departments. These reports should be submitted to the School Postgraduate Studies Committee. The Committee should then forward these reports to Senate for ratification.

7.9. **A candidate who fails the mini-dissertation will be allowed to resubmit within a period not exceeding 6 months.**

7.10 Students must submit five bound copies of the final mini-dissertation to their departments for onward transmission to the Examination Section. These mini-dissertations must be hard bound after finalization.

S. 8 ASSESSMENT METHOD FOR MASTERS DEGREE BY COURSEWORK

8.1 The examination comprises a minimum of five (5) papers (may vary depending on individual departmental requirements) and a mini-dissertation.

8.2 Individual departments will, where applicable prescribe compulsory papers to be taken.

8.3 The student must write the relevant examinations during the year of registration (i.e., Jun/Jul) and (Nov/Dec) of the year of registration.

8.4 **To pass the examination the student must obtain an average of 50% in each individual paper.**

S. 9 ASSESSMENT METHOD FOR MASTERS DEGREE BY RESEARCH

9.1 The examination consists of a dissertation based on a topic recommended by the Head of Department and approved by Senate.

9.2 A dissertation may not be submitted until one year has elapsed after completion of the relevant honours degree.

9.3. The dissertation will be examined by both internal and external examiners. An oral examination may be required.

S.10 ASSESSMENT METHOD FOR DOCTOR of PHILOSOPHY IN AGRICULTURE AND DOCTOR of PHILOSOPHY IN RURAL DEVELOPMENT (AGPPRD)

10.1 A Doctor's degree is awarded on the basis of a thesis only.

10.2 The degree may be conferred on a candidate after a period of two years has elapsed since he/she has obtained the Masters degree.

10.3 A candidate for the doctoral degree has to present himself / herself for the oral defense of his / her thesis before the examination committee as part of the assessment criteria for the degree.

S.11 COMPOSITION OF THE CURRICULA FOR UNDERGRADUATE DEGREES

BACHELOR OF SCIENCE IN AGRICULTURE (AGRCULTURAL ECONOMICS SPECIALIZATION)

AGBAAE

Year I		Year II		Year III		Year IV	
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**
ACC 1142 (12) ECO 1141 (12) ECS 1141 (12) CHE 1140 (12) MAT 1143 (12) PHY 1127 (6)	ACC 1244 (12) AGR 1231 (9) BIO 1243 (12) CHE 1221 (6) CHE 1222 (6) ECO 1241 (12) ECS 1245 (12)	ANS 2131 (9) AEC 2141 (12) AGR 2141 (9) BMA 1141 (12) ECO 2141 (12) SSC 2141 (12) STA 1149 (12)	AGM 2241 (12) BMA 1241 (12) ECO 2241 (12) STA 1248 (12)	AEC 3141 (12) AEC 3142 (12) AEC 3143 (12) ECO 3141 (12) EXT 2141 (12)	ECO 3241 (12) AEC 3242 (12) AEC 3243 (12) AGM 3241 (12) EXT 3241 (12)	AEC 4141 (12) AEC 4142 (12) AEC 4381 (15) WIL 4182 (30)	AEC 4241 (12) AEC 4242 (12) AEC 4381 (15) CRD 4241 (12)

BACHELOR OF SCIENCE IN AGRICULTURE (AGRIBUSINESS MANAGEMENT SPECIALIZATION)

AGBAAM

Year I		Year II		Year III		Year IV	
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**
ACC 1142 (12) BIO 1142 (16) ECS 1141 (12) STA 1149 (12) MAT 1143 (12) CHE 1140 (12)	ACC 1244 (12) AGR 1231 (9) BIO 1243 (12) ECS 1245 (12) STA 1249 (8)	PHY 1127 (6) AEC 2141 (12) AGR 2141 (9) BMA 1141 (12) SSC 2141 (12) EXT 2141 (12)	AGM 2241 (12) ARE 2241 (12) CHE 1222 (6) BMA 1241 (12) ANS 2243 (12)	AEC 3141 (12) AEC 3142 (12) AEC 3143 (12) BMA 2141 (12) FST 2141 (12)	AEC 3242 (12) AEC 3243 (12) AGM 3241 (12) BMA 2241 (12) EXT 3241 (12)	AEC 4141 (12) AEC 4142 (12) AEC 4381 (15) WIL 4182 (30)	AEC 4241 (12) AEC 4242 (12) AEC 4381 (15) CRD 4241 (12)

BACHELOR OF SCIENCE IN AGRICULTURE (ANIMAL SCIENCE SPECIALIZATION)

AGBAAS

Year I		Year II		Year III		Year IV	
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**
BIO 1142 (12) ECO 1141 (12) ECS 1141 (12) CHE 1140 (12) MAT 1143 (12) PHY 1127 (6)	AGR 1231 (9) BIO 1243 (12) CHE 1221 (6) CHE 1222 (6) ECO 1241 (12) ECS 1245 (12) GEN 1241 (12)	AGR 2141 (9) ANS 2131 (9) ANS 2132 (9) EXT 2141 (12) SSC 2141 (12) STA 1149 (12)	AGM 2241 (12) ANS 2231 (9) ANS 2243 (12) ARE 2241 (12) STA 1249 (12)	ANS 3131 (9) ANS 3133 (9) ANS 3141 (12) ANS 3135 (12) ANS 3134 (12) AGR 3131 (9)	ANS 3233 (9) ANS 3234 (9) ANS 3241 (12) ANS 3242 (12) EXT 3241 (12) RME 3248 (12)	WIL 4182 (60) ANS 4381 (30)	ANS 4241 (12) ANS 4242 (12) ARE 4241 (12) CRD 4241 (12)

BACHELOR OF SCIENCE IN AGRICULTURE (HORTICULTURAL SCIENCES SPECIALIZATION)

AGBAHS

Year I		Year II		Year III		Year IV	
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**
BIO 1142 (12) CHE 1140 (12) ECO 1141 (12) ECS 1141 (12) MAT 1143 (12) PHY 1127 (6)	AGR 1231 (9) BIO 1243 (12) CHE 1221 (6) CHE 1222 (6) ECO 1241 (12) ECS 1245 (12) GEN 1241 (12)	AGR 2141 (12) ANS 2131 (9) EXT 2141 (12) HRT 2141 (12) PPR 2141 (12) SSC 2141 (12) STA 1149 (12)	ARE 2241 (12) BCM 2221 (6) BCM 2222 (6) HRT 2241 (12) STA 1249 (12)	HRT 3145 (9) HRT 3134 (9) ARE 3145 (12) AGR 3141 (12)	HRT 3231 (9) HRT 3242 (12) HRT 3243 (12) PPR 3231 (9) PPR 3241 (12) EXT 3241 (12) RME 3248 (12)	HRT 4381 (30) WIL 4182 (60)	HRT 4242 (12) HRT 4243 (9) HRT 4244 (12) CRD 4241 (12)

BACHELOR OF SCIENCE IN AGRICULTURE (AGRONOMY & CROP SCIENCE SPECIALIZATION)

AGBACS

Year I		Year II		Year III		Year IV	
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**
BIO 1142 (12) CHE 1140 (12) ECO 1141 (12) ECS 1141 (12) MAT 1143 (12) PHY 1127 (6)	AGR 1231 (9) BIO 1243 (12) CHE 1221 (6) CHE 1222 (6) ECO 1241 (12) ECS 1245 (12) GEN 1241 (12)	AEC 2141 (12) ANS 2131 (9) BCM 2121 (6) BCM 2122 (6) EXT 2141 (12) HRT 2141 (12) SSC 2141 (12) STA 1149 (12)	AGM 2241 (12) AGR 2241 (12) ARE 2241 (12) STA 1249 (12)	AEC 3141 (12) AGR 3141 (12) AGR 3131 (12) AGR 3133 (12) PPR 3141 (12) SSC 3142 (12)	AGR 3241 (12) PPR 3231 (12) PPR 3241 (12) CRD 3241 (12) RME 3248 (12)	AGR 4381 (15) WIL 4182 (60)	AGR 4381 (15) AGR 4232 (12) PPR 4241 (12)

BACHELOR OF SCIENCE IN AGRICULTURE (SOIL SCIENCE SPECIALIZATION)

AGBASS

Year I		Year II		Year III		Year IV	
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**
BIO 1142 (12) CHE 1140 (12) ECO 1141 (12) ECS 1141 (12) MAT 1143 (12) PHY 1127 (6)	AGR 1231 (9) BIO 1243 (12) CHE 1221 (6) CHE 1222 (6) ECO 1241 (12) ECS 1245 (12) GEN 1241 (12)	AGR 2141 (12) ANS 2131 (9) BCM 2121 (6) BCM 2122 (6) EXT 2141 (12) SSC 2141 (12) STA 1149 (12)	ARE 2231 (9) ARE 2241 (12) CHE 2220 (6) STA 1249 (12)	AGR 3141 (12) ARE 3147 (16) ARE 3148 (8) SSC 3142 (12) SSC 3143 (12) SSC 3144 (12)	AGR 3231 (12) EXT 3241 (12) SSC 3241 (12) SSC 3242 (12) RME 3248 (12)	WIL 4182 (60) SSC 4381 (15)	SSC 4241 (12) SSC 4244 (12) SSC 4245 (12) CRD 4241 (12) SSC 4381 (15)

BACHELOR OF SCIENCE IN FOOD SCIENCE AND TECHNOLOGY (AGBFST)

AGBFST

Year I		Year II		Year III		Year IV	
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**
BIO 1141 (12) BIO 1142 (12) ECS 1141 (12) CHE 1140 (12) MAT 1143 (12) PHY 1127 (6)	AGR 1231 (9) BIO 1243 (12) CHE 1221 (6) CHE 1222 (6) ECS 1245 (12) MAT 1243 (12) PHY 1227 (6)	BCM 2121 (6) BCM 2122 (6) BMA 1141 (12) FST 2141 (12) MBY 2121 (6) STA 1149 (12)	BCM 2221 (6) BCM 2222 (6) FST 2221 (6) FST 2242 (12) FST 2243 (12) FST 2244 (12) STA 1249 (12)	FST 3141 (12) FSN 3142 (12) FSN 3143 (12) FSN 3381 (12)	FSN 3241 (12) FSN 3242 (12) FSN 3243 (12) FSN 3381 FSN 3244 (12) RME 3248 (12)	FSN 4141 (60) FST 4381 (30)	FSN 4241 (12) FST 4381 FSN 4242 (12) CRD 4241 (12) FST 4243 (12)

BACHELOR OF SCIENCE IN FORESTRY

(AGBBFR)

Year I		Year II		Year III		Year IV	
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**
BIO 1142 (12) ECO 1141 (12) ECS 1141 (12) CHE 1140 (12) MAT 1143 (12) PHY 1127 (6)	AGR 1231 (9) BIO 1243 (12) CHE 1221 (6) CHE 1222 (6) ECO 1241 (12) ECS 1245 (12) GEN 1241 (12)	FRT 2141 (12) FRT 2144 (12) FRT 2145 (12) FRT 2146 (12) SSC 2141 (12) STA 1149 (12)	FRT 2241 (12) FRT 2243 (12) FRT 2244 (12) STA 1249 (12)	AEC 3143 (12) FRT 3141 (12) FRT 3142 (12) FRT 3144 (12)	FRT 3242 (12) FRT 3243 (12) FRT 3244 (12) FRT 3245 (12) FRT 3246 (12) RME 3248 (12)	FRT 4381 (30) WIL 4182 (60)	FRT 4241 (12) FRT 4242 (12) FRT 4243 (12) FRT 4244 (12) FRT 4245 (12) CRD 4241 (12)

BACHELOR OF SCIENCE IN AGRICULTURAL AND BIOSYSTEMS ENGINEERING
(NB: First intake in 2017)

AGBABE

Year I		**Year II**		**Year III**		**Year IV**	
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**	**Semester 1**	**Semester 2**
ABE 1531 (8) ABE 1532 (12) ABE 1533 (12) ABE 1534 (12) ABE 1535 (12) ABE 1536 (8) ABE 1537 (8)	ABE 1631 (8) ABE 1632 (12) ABE 1633 (12) ABE 1634 (8) ABE 1635 (12) ABE 1636 (12) ABE 1637 (8)	ABE 2131 (12) ABE 2132 (12) ABE 2133 (8) ABE 2134 (12) ABE 2135 (8) ABE 2136 (8) ABE 2137 (8) ABE 2138 (8)	ABE 2231 (12) ABE 2232 (12) ABE 2233 (12) ABE 2234 (8) ABE 2235 (8) ABE 2236 (8) ABE 2237 (8) ABE 3238 (8)	ABE 3131 (8) ABE 3132 (8) ABE 3133 (8) ABE 3134 (8) ABE 3135 (16) ABE 3136 (12) ABE 3137 (12)	ABE 3231 (12) ABE 3232 (12) ABE 3233 (8) ABE 3234 (12) ABE 3235 (8) ABE 3236 (8) ABE 3237 (8) ABE 3238 (8)	***SESSION I*** ABE 4000 ***SESSION II*** ABE 4132 (8) ABE 4133 (8) ABE 4134 (8) ABE 4135 (8) ABE 4136 (12) ABE 4137 (8) ABE 4138 (12)	ABE 4231 (16) ABE 4232 (8) ABE 4999 (0) ***SELECT 40 CREDITS FROM MODULES BELOW:*** ABE 4223(8) ABE 4224(8) ABE 4233(8) ABE 4234(8) ABE 4235(8) ABE 4236(8) ABE4237(16) ABE 4238(8) ABE 4239(8) ABE 4241(8) ABE 4243(8) ABI 4231 (8) ABI 4232(16) ABI 4234 (8) ABI 4235 (8) ABI 4242 (8) ABS 4231 (8) ABS4232(16) ABS 4233 (8) ABS 4234 (8) ABS 4235 (8) ABS 4236 (8) ABS 4237 (8) ABS 4238 (8)

S. 12 COMPOSITION OF THE CURRICULUM FOR BA(Hons) IN RURAL DEVELOPMENT

BA HONOURS IN RURAL DEVELOPMENT (AGHHRD)

Semester 1		Semester 2	
Module	Credits	Module	Credits
IRD 5141 IRD 5142 IRD 5143 IRD 5144 IRD 5399	21 18 12 12 30	IRD 5241 IRD 5242 IRD 5231 Elective Modules IRD 5221 IRD 5222	14 12 14 8 8

S. 14 COMPOSITION OF THE CURRICULUM FOR MASTER OF SCIENCE IN AGRICULTURE (COURSEWORK AND MINI-DISSERTATION)

MASTER OF SCIENCE IN AGRICULTURE (AGMAAE)(Agricultural Economics)

Year 1		Year 2
Semester 1	Semester 2	Full year
AEC 6541 AEC 6542 AEC 6543	AEC 6641 AEC 6642 EXT 6641	AEC 6099 (Dissertation)

MASTER OF SCIENCE IN AGRICULTURE (AGMAAS)(Animal Science)

Year 1		Year 2
Semester 1	Semester 2	Full year
Compulsory module ANS 6531 Elective modules (Choose two) ANS 6542 ANS 6543 ANS 6544 ANS 654	Compulsory module STA 6649 ANS 6631 Elective modules (Choose two) ANS 6642 ANS 6643 ANS 6644 ANS 6645	ANS 6099 (Dissertation)

MASTER OF SCIENCE IN AGRICULTURE (AGMSHS)(Horticultural Sciences)

Year 1		Year 2
Semester 1	Semester 2	Full year
HRT 6541 HRT 6542 HRT 6543 AGR 6531	HRT 6641 HRT 6642 HRT 6643 AGR 6642	HRT 6099 (Dissertation) HRT 6544 (1st sem module)

MASTER OF SCIENCE IN AGRICULTURE (AGMAPP) (Plant Production/Agronomy)

Year 1		Year 2
Semester 1	Semester 2	Full year
AGR 6531 AGR 6542 PPR 6541 SSC 4542 NB: Electives up to 42 credits will be selected with the guidance of the supervisory committee in related disciplines and may be offered in any of the two years.	AGR 6631 AGR 6642 STA 6649	AGR 6099 (Dissertation)

MASTER OF SCIENCE IN AGRICULTURE (AGMASS) (Soil Science)

Year 1		Year 2
Semester 1	Semester 2	Full year
SSC 6531 SSC 6532 SSC 6533 NB: Optional up to 42 credits will be selected with the guidance of the supervisory committee in related disciplines and may be offered in any of the two years.	SSC 6631 SSC 6632 STA 6649 Optional modules SSC 6633 SSC 6634 SSC 6635 AGR 6642	SSC 6099 (Dissertation)

MASTER OF SCIENCE IN FOOD SCIENCE AND TECHNOLOGY (AGMFST)

Year 1		Year 2
Semester 1	Semester 2	Full year
FST 6541 FST 6542 FST 6543	FST 6641 FST 6642 FST 6643	FST 6099 (Dissertation)

S. 15 MODULES OFFERED BY DEPARTMENTS

Department of Agricultural Economics and Agribusiness

AEC 2541/2141: Introduction to agricultural economics
AGM 2641/2241: Introduction to agribusiness management
AEC 3541/3141: Farm Business management
AEC 3542/3142: Agricultural sector planning and project appraisal
AEC 3543/3143: Introduction to mathematical economics
AEC 3642/3242: Introduction to econometrics.
AEC 3643/3243: Research Methods for Agricultural Economics and Agribusiness
AGM 3641/3241: Agribusiness management and applications
AEC 4541/4141: Agricultural production economics
AEC 4542/4142: Agricultural policy in developing countries
AEC 4641/4241: Natural resource and environmental economics
AEC 4642/4242: Markets and price analysis
AEC 4081/4381: Project and seminar presentation
EXT 2541/2141: Introduction to rural sociology
EXT 3641/3241: Introduction to agricultural extension
EXT 5641: Communication and extension for rural development
AEC 6541: Advanced agricultural production economics
AEC 6542: Advanced agribusiness management & marketing
AEC 6543: Research methodology
AEC 6641: Advanced agricultural policy
AEC 6642: Research project and seminar
EXT 6641: Advanced agricultural extension education
AEC 6099: Dissertation
AEC 7099: Thesis

Department of Agricultural and Rural Engineering (Modules for the new AGBABE degree programme) (First Intake 2017)

ABE 1131 Technical Communication skills
ABE 1132 Introduction to Agricultural and Biosystems Engineering
ABE 1133 Physics I
ABE 1134 Chemistry I
ABE 1135 Pure Mathematics I
ABE 1136 Applied Mathematics I
ABE 1137 Engineering Drawing I
ABE 1231 Introduction to Agricultural Sciences
ABE 1232 Physics II (**Prerequisites ABE 1536/1136)**
ABE 1233 Chemistry II (**Prerequisites ABE 1534/1134)**
ABE 1234 Earth and Environmental Science
ABE 1235 Pure Mathematics II (**Prerequisites ABE 1535/1135**)
ABE 1236 Applied Mathematics II (**Prerequisites ABE 1536/1136**)
ABE 1237 Fundamentals of Computing
ABE 2131 Engineering Mathematics I (**Prerequisites ABE 1635/1235, ABE 1636/1236**)
ABE 2132 Electrical Engineering (**Prerequisites ABE 1632/1232**)
ABE 2133 Thermodynamics I (**Prerequisites ABE 1632/1232**)
ABE 2134 Solid and Structural Mechanics I (**Prerequisites ABE 1632/1232**)
ABE 2135 Mechanics of Machines I (**Prerequisites ABE 1632/1232**)
ABE 2136 Material Science and Engineering (**Prerequisites ABE 1532/1132**)
ABE 2137 Engineering Drawing II (**Prerequisites ABE 1537/1137**)
ABE 2138 Fluid Mechanics I (**Prerequisites ABE 1632/1232**)
ABE 2231 Engineering Mathematics II (**Prerequisites 2531/2131**)
ABE 2232 Computer Programming for Engineers (**Prerequisites ABE 1637/1237**)
ABE 2233 Engineering Surveying (**Prerequisites ABE 2531/2131**)
ABE 2234 Solid and Structural Mechanics II (**Prerequisites ABE 2534/2134**)
ABE 2235 Mechanics of Machines II (**Prerequisites ABE 2535/2135**)
ABE 2236 Electronics (**Prerequisites ABE 1632/1232**)
ABE 2237 Materials Processing (**Prerequisites ABE 2536 /2136**)
ABE 2238 Fluid Mechanics II (**Prerequisites ABE 2538/2138**)
ABE 3131 Renewable Energy Resources and Technologies (**Prerequisites ABE 1533/1133**)
ABE 3132 Thermodynamics II (**Prerequisites ABE 2533/2133**)
ABE 3133 Operations Research (**Prerequisites ABE 1532/1132**)
ABE 3134 Soil Science (**Prerequisites ABE 1532/1132**)
ABE 3135 Instrumentation (**Prerequisites ABE 2636/2236**)
ABE 3136 Engineering Hydrology and Meteorology (**Prerequisites ABE2632/2232**)
ABE 3137 Statistical Methods and Experimental Design (**Prerequisites ABE 2632/2232, ABE 1635/1235**)
ABE 3231 Soil dynamics and Mechanics (**Prerequisites ABE 1532/1132**)
ABE 3232 Irrigation and Drainage Engineering (**Prerequisites ABE 3536/3136, ABE 1532/1132**)

ABE 3233 Tractor Power Engineering (**Prerequisites ABE 2635/2235**)
ABE 3234 Structural Design (**Prerequisites ABE 2634/2234**)
ABE 3235 Process and Food Engineering (**Prerequisites ABE 1631/1231**)
ABE 3236 Principles of Microeconomics
ABE 3237 Heat and Mass Transfer (**Prerequisites ABE 3532/3132**)
ABE 3238 Rural Water Supply and Sanitation (**Prerequisites ABE 3536/3136**)
Session I Comp 4
ABE 4000 Industrial/Field Attachment (**Prerequisites – PASSED ALL YEAR 3 MODULES**)
Session II
ABE 4132 Engineering Economy (**Prerequisites ABE 3633/3233**)
ABE 4133 Built Environment Engineering (**Prerequisites ABE 2633/2233**)
ABE 4134 Soil and Water Conservation Engineering (**Prerequisites ABE 1634/1234, ABE 3534/3134**)
ABE 4135 Entrepreneurship and Product Development (**Prerequisites ABE 4532/4132**)
ABE 4136 Design Project I* (**Prerequisites – PASSED ALL YEAR 3 MODULES**)
ABE 4137 Project Planning and Management (**Prerequisites ABE 3537/3137**)
ABE 4138 Rural Structures (**Prerequisites ABE 2633/2233**)
ABE 4231 Design Project II – CONTINUES FROM SESSION I (**Prerequisites ABE 4536/4136**)
ABE 4232 Electrification (**Prerequisites ABE 2532/2132**)
ABE 4999 ECSA outcome portfolio
ABE 4233 Conservation and Precision Agriculture (**Prerequisites ABE 3534/3134**)
ABI 4242 Water Systems Engineering (**Prerequisites ABE 3632/3232, ABE 3638/3238**)
ABE 4234 Mechanization & Machinery Management (**Prerequisites ABE 3633/3233**)
ABE 4235 Aquatic Machinery Engineering (**Prerequisites ABE 3633/3233**)
ABE 4237 Tractor Power and Machinery Systems Design (**Prerequisites ABE 3633/3233**)
ABE 4236 Transport Systems (**Prerequisites ABE 3633/3233, ABE 4538/4138**)
ABE 4238 Land Development Machinery (**Prerequisites ABE 3633/3233**)
ABE 4239 Minor Roads (**Prerequisites ABE 3631/3231, ABE 4538/4138**)
ABE 4223 Watershed Management (**Prerequisites ABE 3536/3136**)
ABE 4241 Construction Management (**Prerequisites ABE 4533/4133**)
ABE 4224 Rural Extension & Technology Transfer (**Prerequisites ABE 4535/4135, ABE 4532/4132**)
ABE 4243 Geo-Information Systems (**Prerequisites ABE 2633/2233**)
ABI 4231 Hydrological Design of Reservoirs (**Prerequisites ABE 3536/3136**)
ABI 4232 Design of Irrigation and Drainage Systems (**Prerequisites ABE 3632/3232**)
ABI 4234 Groundwater Hydrology (**Prerequisites ABE 3536/3136**)
ABI 4235 Surface Water Hydrology (**Prerequisites ABE 3536/3136**)
ABS 4231 Refrigeration and air conditioning (**Prerequisites ABE 3635/3235**)
ABS 4232 Storage of agricultural products (**Prerequisites ABE 3635/3235**)
ABS 4233 Processing plant design (**Prerequisites ABE 3635/3235**)
ABS 4234 Food engineering systems (**Prerequisites ABE 3635/3235**)
ABS 4235 Dairy technology (**Prerequisites ABE 3635/3235**)
ABS 4236 Post harvest technology (**Prerequisites ABE 3635/3235**)
ABS 4237 Agro-Industrial Waste Management (**Prerequisites ABE 1634/1234**)
ABS 4238 Packaging technology **(Prerequisites ABE 3635/3235)**

Department of Animal Science

GEN 1641/1241: Principles of genetics
ANS 2531/2131: Introduction to Animal production
ANS 2532/2132: Biochemical principles in animal nutrition
ANS 2541/2141: Basic principles of nutrition
ANS 2631/2231: Principles of animal nutrition
ANS 2641/2241: Feeding of farm livestock
ANS 2643/2243: Anatomy and physiology of farm animals
ANS 3531/3131: Genetic principles in animal breeding
ANS 3533/3133: Management of dairy cattle
ANS 3541/3141: Applied animal nutrition
ANS 3535/3135: Management of small stock
ANS 3534/3134: Management of beef cattle
ANS 3633/3233: Animal health
ANS 3634/3234: Pig production
ANS 3641/3241: Reproductive physiology
ANS 3642/3242: Poultry production
ANS 4081/4381: Seminar/Scientific Project
ANS 4641/4241: Applied animal breeding
ANS 4642/4242: Livestock products
WIL 4582/4182: Work integrated learning
ANS 5531: The science and management of monogastric animals
ANS 5532: The science and management of ruminant animals
ANS 5631: Selected topics in animal production
ANS 5632: Animal health and disease control
ANS 5099: Research project and mini dissertation

ANS 6541: Agricultural biometry
ANS 6531: Seminar presentation /special topic
ANS 6542: Ruminant nutrition
ANS 6543: Advance large stock production
ANS 6544: Advance pig production
ANS 6545: Advance animal breeding
ANS 6631: Seminar presentation / special topic
ANS 6642: Non ruminant nutrition
ANS 6643: Advance animal physiology and anatomy
ANS 6644: Advance small stock production
ANS 6645: Advance poultry production
ANS 6099: Dissertation
ANS 7099: Thesis

Department of Food Science and Technology

FST 2541/2141: Introduction to food science and technology
FST 2621/2221: Introduction to food and nutrition
FST 2642/2242 Fundamentals of Post-harvest biology and storage technology
FST 2643/2243: Fundamentals of food preservation technology
FST 2644/2244: Food process engineering **(Prerequisites PHY 1527/ 1127and PHY 1627/1227)**
FST 3541/3141: Principles of human nutrition (**Prerequisites FST 2621/ FST 2221)**
FSN 3542/3142: Food chemistry I **(Prerequisites BCM 2521/ BCM 2121 and BCM 2522/ 2122)**
FSN 3543/3143: Food Microbiology **(Prerequisites MBY 2521/ 2121)**
FSN 3081/3381: Food commodity processing
FSN 3641/3241: Product development and sensory evaluation of food
FSN 3642/3242: Food chemistry II **(Prerequisites BCM 2621/2221 and BCM 2622/2222)**
FSN 3643/3243: Quality management systems
FSN 3644/3244: Cereal science and technology **(Prerequisites FST 2642/2242 and FST 2643/2243)**
FST 4541/4141: Industrial attachment with food industry for six months
FSN 4641/4241: Fruit and vegetable technology **(Prerequisites FST 2642/2242 and FST 3642/3242)**
FSN 4642/4242: Meat and poultry products technology (**Prerequisites FSN 3081)**
FST 4643/4243: Food machinery **(Prerequisites FST 2642/2242 and FST 2643/2243 and 2644/2244)**
FST 4081/4381: Research project
FST 6541: Quality assurance and marketing in food process enterprise
FST 6542: Food machinery
FST 6543: Advances in post-harvest technology
FST 6641: Seminar presentation
FST 6642: Research project
FST 6643: Technical report writing
FST 6099: Dissertation
FST 7099: Thesis

Department of Forestry

FRT 2541/2141: Forest ecology and tree identification **(Prereq BIO 1243)**
FRT 2544/2144: Forest health and protection I **(Prereq AGR 2141)**
FRT 2545/2145: Introduction to forest economics **(Prereq ECO 1141 and ECO 1241)**
FRT 2546/2146: GIS and spatial analysis in forestry
FRT 2641/2241: Introduction to forestry engineering
FRT 2643/2243: Forest nursery management and propagation
FRT 2644/2244: Forest valuation and investments **(Prereq FRT 2145)**
FRT 3541/3141: Forest management
FRT 3542/3142: Sawmilling
FRT 3544/3144: Forest resources assessment
FRT 3642/3242: Forest policy
FRT 3643/3243: Silviculture I
FRT 3644/3244: Forest health and protection II
FRT 3645/3245: Logging and roads
FRT 3646/3246: Introduction to forestry extension
FRT 4641/4241: Agroforestry
FRT 4642/4242: Community forestry
FRT 4643/4243: Timber transportation and planning
FRT 4644/4244: Silviculture II
FRT 4645/4245: Forest conservation (new code given because FRT 4642 already exists)
FRT 4081/4381: Project and seminar presentation

Department of Plant and Soil Sciences

Horticultural Sciences Section

HRT 2541/2141: Principles of horticultural crops production
HRT 2641/2241: Plant propagation
HRT 3545/3145: Ornamental horticulture
HRT 3533/3133: Plant tissue culture
HRT 3534/3134: Citriculture/Citrus production
HRT 3544/3144: Controlled environment horticulture
HRT 3631/3231: Olericulture
HRT 3642/3242: Turf grass and landscape horticulture
HRT 3643/3243: Miscellaneous horticultural crops (Spice, herbs, beverages and medicinal crops, Temperate fruits and nut trees production)
HRT 46424242: Agriculture biotechnology
HRT 4643/4243: Tropical and subtropical fruit and nut trees production
HRT 4644/4244: Postharvest physiology of horticultural crops
HRT 4081/4381: Project and seminar presentation
HRT 5531: Advanced plant propagation
HRT 5532: Advanced pomology
HRT 5533: Advanced olericulture
HRT 5621: Special topics in horticultural sciences
HRT 5622: Sustainable horticultural crops production
HRT 5099: Research project and mini dissertation
HRT 6541: Data analysis & evaluation techniques in HRT
HRT 6542: Agriculture biotechnology
HRT 6543: Special Topics in HRT crop production
HRT 6544: Guide to interdisciplinary research
HRT 6641: Advances in Horticultural crops production systems
HRT 6642: Post harvest diseases: Tropical & subtropical HRT crops
HRT 6643: Advances in Horticultural crop protection
HRT 6099: Dissertation
HRT 7099: Thesis

Crop Science Section

AGR 1631/1231: Agriculture and Humankind
AGR 2641/2241: Principles of plant production (**Prerequisite AGR 1631/1231**)
AGR 3541/3141: Principles & application of plant physiology in plant production (**Prerequisites BIO 1542/1142, BIO 1643/1243**)
AGR 3641/3241: Introductory plant breeding and seed production (**Prerequisites GEN 1641/1241, AGR 3541/3141**)
AGR 3531/3131: Management of natural and cultivated pastures (**Prerequisite AGR 2641/2241**)
AGR 3533/3133: Bio-energy crops: Agronomy and postharvest processing (**Prerequisite AGR 2641/2241**)
AGR 4632/4232: Agronomy of selected field crops (**Prerequisite AGR 2641/2241, AGR 3641/3241, PPR 3641/3241**)
AGR 4081/4381: Project and seminar presentation
AGR 5531: Agronomy of cereal crops
AGR 5631: Agronomy of legumes and tuber crops
PPR 3541/3141: Introduction to plant protection
PPR 3631/3231: Agricultural entomology (**Prerequisite PPR 3541/3141**)
PPR 3641/3241: Weed science (**Prerequisite PPR 3541/3141**)
PPR 4641/4241: Plant pathology (**Prerequisite PPR 3541/3141**)
PPR 5621: Weed science
PPR 5632: Disease and insect pest control
PPR 5099: Research project and mini dissertation
AGR 6531: Special topics in crop production
AGR 6542: Special topics in plant breeding
AGR 6631: Crop production systems
AGR 6642: Advances in applied crop physiology
PPR 6541: Advanced plant protection
AGR 6099: Dissertation
AGR 7099: Thesis

Soil Science Section

SSC 2541/2141: Introduction to Soil Science
SSC 3542/3142: Soil chemistry (**Prerequisite SSC 2541/2141**)
SSC 3543/3143: Pedology (**Prerequisite SSC 2541/2141**)

SSC 3544/3144: Soil physics (**Prerequisite SSC 2541/2141**)
SSC 3641/3241: Soil survey, classification and mapping (**Prerequisite SSC 3543/3143**)
SSC 3642/3242: Soil microbiology (**Prerequisite SSC 2541/2141**)
SSC 4641/4241: Soil fertility and plant nutrition (**Prerequisite SSC 3542**)
SSC 4644/4244: Land evaluation (**Prerequisite SSC 2541/2141**)
SSC 4645/4245: Soil, water and plant analysis (**Prerequisite SSC 3542/3142**)
SSC 4081/4381: Project and Seminar presentation
SSC 5531: Soil genesis and morphology
SSC 5631: Soil survey and classification
SSC 5632: Soil technology and conservation
SSC 5099: Research project and mini-dissertation
SSC 6531: Soil genesis, survey and classification
SSC 6532: Soil chemistry and clay mineralogy
SSC 6533: Soil physics
SSC 6631: Project and seminar presentation
SSC 6632: Chemical analysis of soils, plants, fertilizer and water
SSC 6633: Soil fertility and fertilizer use
SSC 6634: Soil biology and biochemistry
SSC 6635: Soil technology and conservation
SSC 6099: Dissertation
SSC 7099: Thesis

Institute for Rural Development

IRD 5541/5141: Rural Development Theories and Practice
IRD 5542/5142: Research Methods 1
IRD 5543/5143: Project Management
IRD 5544/5144: Entrepreneurship
IRD 5641/5241: Institutions for Rural Development
IRD 5631/5231: Contemporary Issues in Rural Development
IRD 5642/5242: Research Methods 2
IRD 5621/5221: Ethics in Community-based International Research
IRD 5622/5222: People, Culture and the Environment
IRD 5099/5399: Research Project
IRD 6099/6399: Dissertation
IRD 7099/7399: Thesis

S. 18 SYLLABI

DEPARTMENT OF AGRICULTURAL AND AGRIBUSINESS MANAGEMENT (Module content)

AEC 2541/2141 Introduction to agricultural economics
The scope and nature of agricultural economics. The price mechanism and allocation of resources. Supply and Demand Analysis. Factor-Factor and Product-Product Relations. Risk Management and Agricultural production system.

EXT 2541/2141 Introduction to rural sociology
Rural Institutions and Organisations in rural areas. Structural set up and decision making in rural areas. Communications and diffusion of innovations in rural societies. Cognitive, attitudinal and interpersonal factors influencing social change. Some selected case studies of social action in rural African Communities.

AGM 2641/2241 Introduction to agribusiness management
Prerequisite AEC 2541/2141
The nature of agribusiness: Define agribusiness. Overview of agribusiness in South Africa. Careers in agribusiness. Agribusiness management concepts. Management and its functions. Marketing management, Financial management Human resources management. Entrepreneurship. Define and describe entrepreneurship. Personal attributes of entrepreneurs. Entrepreneurship opportunities in agribusiness. Review of agribusiness case studies in South Africa. Identify and describe the types of business ownership (sole proprietor, partnership, corporation (etc). Advantages and disadvantages of the different types of business. Review of cooperatives in agribusiness. The business plan.

AEC 3541/3141 Farm business management
Prerequisites AEC 2541/2141
Organisational Structure. Leadership. Motivation. Functions of personnel management. Legislation controlling human resource management. Farm Machinery management. Investment in Fixed assets. Business objectives. Farm management information. Risk management. Budgeting. Time Value of money and Farm credit

AEC 3542/3142 Agricultural sector planning and project appraisal
Prerequisite AEC 2541/2141
Resource allocation and agricultural development planning. Macro-plans versus Micro-plans. Problems of planning for agricultural development in African Countries. Project preparations and appraisal; Cash Flow Analysis. Cost-Benefit Analysis. Internal Rates of Return. Sensitivity Analysis. Problems of project preparations and appraisal in African Countries.

AEC 3543/3143 Introduction to mathematical economics
Prerequisite MAT 1543/1143
Use of linear and non-linear equations in economics; solving equations. Logarithms and indices. Use of differentiation in economics, rules of differentiation, partial differentiation, differential equations, difference equations. Constrained and unconstrained optimisation. Use of integration in economics, rules of integration. Matrix algebra and its applications in economics. Mathematical programming.

AEC 3642/3242 Introduction to econometrics
Prerequisites STA 1648/1248 and AEC 3543/3143
Purpose, role and limitations of Econometrics. Revision of hypothesis tests and point and interval estimation. Elementary Econometrics: regression theory; regression and variance analysis; non-linear regression. Dummy variables. Estimation of parameters and interpretation. Violations of the classical assumptions of linear regression: heteroscedasticity; auto-correlation; multicollinearity; and their implications on parameter estimates. Dealing with time-series and lagged variables. Introduction to computer packages.

AEC 3643/3243 Research methods for Agricultural Economics and Agribusiness
Prerequisites STA 1549/1149 and STA 1648/1248
Definition of research. Research design. Qualitative and qualitative research. Population and sampling techniques. Data collection, analyses and presentation techniques. Referencing techniques. Proposal writing.

AGM 3641/3241 Agribusiness management and applications
Prerequisite AGM 2641/2241
Components of the agribusiness sector and practical examples from the South African economy. The size of the agribusiness sector in South Africa. Agribusiness Management. Agribusiness Supply Chain Management. Forms of organisations in the South African agribusiness sector. Legislations affecting the agribusiness sector in South Africa. An empirical study of one component of the agribusiness sector in South Africa.

EXT 3641/3241 Introduction to agricultural extension
Origin and philosophy of agricultural Extension. Organisation and structure of agricultural extension in South Africa. Extension communication methods. Group Dynamics and leadership role in extension. Case studies and group discussions of extension methods in developing countries.

AEC 4081/4381 Project and seminar presentation
Prerequisite AEC 3643/3243
The philosophy of Agric. economic research. The framework for research proposal. Research background and research problem statement. Research objectives and hypothesis. Theoretical framework and review of literature. Data collection techniques and data analysis. Presentation of research results. Project research report writing. Seminar on research findings.

AEC 4541/4141 Agricultural production economics
Prerequisite AEC 3541/3141
Goals of agricultural production systems. Agricultural production functions for crops, and livestock. Factor-Factor and product-product relations. Cost Functions and returns to scale in agriculture. Supply response in agriculture. Linear programming as planning tools for agricultural production system.

AEC 4542/4142 Agricultural policy in developing countries
Prerequisite AEC 2541/2141
Role of agriculture in the economic development process. Macro-economic goals in relation to agriculture in the economic development process. Agricultural policies relating to land use and land reform; credit, water use, extension, research and marketing of agricultural products. Structural adjustments and their impact on African Agriculture. Agricultural institutions and their role in poverty alleviation in developing countries.

AEC 4641/4241 Natural resource and environmental economics
Prerequisite AEC 2541/2141
Natural Resource classification. The economic concepts of natural resource use. Renewable and non-renewable resources with specific examples from Africa. Natural resource valuation techniques. Benefit-cost analysis as used in natural resource management. Environmental Impact Assessment. Resource use and environmental pollution. Government policy and pollution control with examples from Africa.

AEC 4642/4242 Markets and price analysis
Prerequisite AEC 2541/2141
Price movements and price cycles for agricultural products with examples from Africa. Market trend analysis and weighted moving average of prices. Economic analysis of agricultural product prices in South Africa. Marketing research and product market surveys. Price control and price intervention policy in South Africa.

WIL 4582/4182 Work-integrated learning
Prerequisite AGM 3641/3241
Practical exposure to agribusiness planning processes. Practical exposure to agribusiness coordination and monitoring activities. Practical exposure to agribusiness control processes. Report on work covered.

DEPARTMENT OF ANIMAL SCIENCE (Module content)

GEN 1641/1241 Principles of genetics
Prerequisites None
Credits 12 .
Module Contents: History of genetics; Mendelian genetics; Multiple alleles; Modified ratios; Sex determination and sex linkage; Structure and functions of the genetic material; Chromosomal and gene mutations; Biotechnology (genetics and society).

ANS 2531/2131 Introduction to animal production
Prerequisites CHE 1540/1140 and CHE 1622/1222
Credits 9
Module content: breeds of livestock and their products; environmental physiology; vegetation and livestock distribution in RSA; selected management practices in animal production; breeding of livestock; grazing systems and veld management practices; diseases of animals and their causes; grading and classification of livestock products

ANS 2532/2132 Biochemical principles of animal nutrition
Prerequisites CHE 1540/1140 and CHE 1622/1222
Credits 9
Module content: an understanding of metabolism, bioenergetics and energy metabolism, final common pathway of energy metabolism including substrate level phosphorylation and oxidative phosphorylation, carbohydrates, lipids and protein and digestion and metabolism in non-ruminants and ruminants, and indicators in pasture and range studies.

ANS 2631/2231 Principles of animal nutrition
Prerequisites ANS 2532/2132
Credits 9
Module content: Feed definition, components and functions, proximate analysis of foods. Carbohydrates, lipids and protein classification, structures, functions and sources. Vitamins and minerals. Digestibility of feeds. Partition of feed energy. Introduction to energy systems. Measures of protein quality for non-ruminants.

ANS 2643/2243 Anatomy and physiology of farm animals
Prerequisites None
Credits 12
Module content: Cell structures and cell physiology, terminology, identification of body parts in anatomy, nervous system, digestive system, respiratory system, excretory system, blood and circulation, reproductive system, endocrine system, homeostasis and its control, immune system.

ANS 3531/3131 Genetic principles in animal breeding
Prerequisites GEN 1641/1241, ANS 2531/2131
Credits 12
Module Content: Genetic properties of a population; Factors that change gene frequencies; Qualitative and Quantitative characters; Types of traits in farm animals; Breeding value; Principles of selection; Aids to selection; Multiple-trait selection; Inbreeding; Crossbreeding in farm animals.

ANS 3533/3133 Management of dairy cattle
Pre-requisite: **ANS 2531 /2131**
Credits: 9
Module content: Dairy breeds, Mating systems, Feeds and feeding of dairy cattle, Fodder flow, Milking program, Herd management. Herd health, Facilities, equipment and technological, developments, Dairy record keeping

ANS 3541/3141 Applied animal nutrition
Pre-requisite: **ANS 2631/2231**
Credits: 12
Module content: Classification of livestock feeds, Feed ingredients of livestock rations; agricultural and industrial waste products, Nutrient requirements for different physiological stages of livestock, Basic principles of ration formulation, Ration formulation using computer software's.

ANS 3543/3143 Management of small stock
Pre-requisite: **ANS 2531/2131**
Credits: 12
Module content: Sheep and goat breeds and their distribution in S.A, Management practices of sheep and goats, Breeding systems, Lamb/kid management, Describe and discuss the feeds and feeding of goats and sheep, Fodder flow planning, Basic flock-health principles, Management calendar, Recordkeeping, Welfare issues.

ANS 3544/3144 Management of beef cattle
Pre-requisite: **ANS 2531/2131**
Credits : 12.
Module content: Beef cattle breeds and their distribution in S.A, Production systems and associated management requirements, Feeds and feeding of beef cattle, Fodder flow planning, Basic flock-health principles, Management calendar, Record keeping, Welfare issues.

ANS 3633/3233 Animal health
Prerequisites ANS 2531/2131 and ANS 2643/2243
Credits 12
Module content: Animal immune system and vaccines, most important pathological conditions: bacterial, viral, protozoal, fungal, toxins. Vaccination programs, first aid, castrations, dehorning, branding, injections, parasites and their control. Poultry diseases.

ANS 3634/3234 Pig production
Pre-requisite: **ANS 2531/2131**
Credits: 9
Module content: Pig breeds and their distribution in SA, Pig production systems and their requirements, Breeding and genetic improvement, Nutrition and feeding, Computer formulation of pig rations, Production schedule for different production goals, Basic pig health principles, Welfare issues.

ANS 3641/3241 Reproductive physiology
Prerequisites ANS 2643/2243
Credits 9
Module content: Hormones and reproduction, spermatogenesis, oogenesis, reproductive cycles, synchronization, physiology, fertilization, gestation and parturition, animal biotechnology and assisted reproduction, poultry reproduction.

ANS 3642/3242 Poultry production
Prerequisites ANS 2531/2131
Credits 12
Module Content: Domestication of poultry; Poultry products Growth; Reproduction – female reproduction: Male reproduction Incubation; Brooding and raising of chicks; Poultry breeding and genetic improvement; Nutrition and feeding; Poultry production systems; Poultry housing and welfare.

ANS 4081/4381 Research project

ANS 4641/4241 Applied animal breeding
Prerequisites ANS 3531/3131
Definition of animal breeding concepts such as trait, phenotypes, genotypes etc. Strategies for genetic improvement of farm animals. Genomics. Introduction to BLUP. Factors affecting the rate of genetic change. Genetic prediction. Inbreeding and relationship. The role of breed societies in the national data base.

ANS 4642/4242 Livestock products
Prerequisites ANS 3543/3143; ANS 3544/3144 and ANS 3642/3242
Meat quality and marketing: Structure and functions of muscle; conversion of muscle to meat. Factors affecting meat quality, pre- and post- gate effects. Consumer requirements, including perceptions and nutritional qualities. Meat processing, determinants of quality. South African market for red meat and poultry. Opportunity for cooperation with each sector. SA role in support of animal products. Milk and milk products: The market for milk and milk products: changing requirements and distribution systems. Manipulation of milk composition and quality – production systems. Processing of milk for liquid consumption – low fat, long life and nutritionally-enhanced products. Requirements and processes for butter, cheese, yoghurt and other milk products. Eggs: Market for eggs and egg products. Quality criteria and their modifications by production practices. Wool and fibre: sheep wool, mohair and cashmere. Skins and hides

DEPARTMENT OF AGRICULTURAL AND RURAL ENGINEERING (Module content)

ARE 2631/2231Agro-meteorology
The module introduces the learner to principles of agricultural meteorology. It gives a learner the basic knowledge on how climate influences agricultural activities. Therefore the module introduces the learner to the elements of weather and climate, measurements and simple analysis of climatic data, climatic surveys and their classifications. Having completed the module, the learner is expected to be able to determine what agricultural enterprises would suit various regions depending on a variety of conditions such a climate and socio-economic factors among others.

ARE 2641/2241Introduction to agricultural mechanization
Prerequisites AGR 1631/1231; ANS 2531/2131; AGR 2541/2141; MAT 1643/1243 and PHY 1527/1127
The module introduces the learner to principles of agricultural engineering and mechanization. It gives a learner a holistic approach towards proper identification, planning and solving related agricultural mechanization problems encountered in the field. The module also introduces the learner to farm machinery working principles (tractors and animal power technologies), crop processing technologies and mechanization systems for agricultural production and processing.

ARE 3531/3131Engineering drawing and design I
To introduce the learners to principles of Engineering drawing and design of machinery parts, systems and other technologies.

ARE 3532/3132Farm workshop practice I
Prerequisite ARE 2641/2241
To give students an understanding of the basic workshop tools, e.g. spanners, sockets, welding machine, poprivert, grease gun, and etc. this will enable the students to be able to fix broken metals and farm implements. This module introduces students to metal work.

ARE 3543/3143: Principles of surveying and measurements
(Prerequisite MAT 1643/1243, PHY 1527/1127)
The module introduces student to surveying and instruments. Both theoretical and field measurement for the following types of surveying are covered: profile surveying (levelling), two-peg test, distance, area and volume measurement, traverse surveys.

ARE 3632/3232Farm workshop practice II
Prerequisite ARE 3532/3132
To give an understanding of the basic wood materials, and how to cut, measure, join and to work on the carpentry activities.

ARE 3545/3145Renewable energy technologies
Prerequisites CHE 1624/1224; MAT 1543/1143 and PHY1527/1127
To develop a good appreciation on how renewable energy technologies play a vital role in agricultural production and improving rural livelihoods

ARE 3641/3241Engineering drawing and design II
Prerequisite ARE 3531/3131
To introduce the learners to advanced Engineering drawing and design of machinery parts, systems and other technologies. (including farm buildings).

ARE 3546/3146Farm structures
ARE 3542/3142Farm structures
Prerequisite ARE 2641/2241
The module introduces the learner to principles of farmyard planning and building technology. Emphasis will be on livestock structures and farm buildings. The module also introduces the learner to basic leveling techniques, site selection and preparation of layout, elementary surveying, elementary building planning and construction. The learner is expected to be aware of the role of farm buildings in agricultural production and livestock enterprises.

ARE 3547/3147Principles of irrigation and drainage
Prerequisites ARE 2631/2231 and ARE 2641/2241
The module introduces the learner to the principles of irrigation and drainage. It gives a learner, knowledge on the importance of irrigation in South African agriculture and the various irrigation methods. Learners acquire skill on how to evaluate the water requirement of crops. It also imparts to the learner the knowledge of irrigation scheduling and removal of excess water from agricultural fields. Having completed the module, the learner is expected to be able to select the appropriate irrigation method for a particular field and determine irrigation schedules.

ARE 3548/3148Soil and water conservation
Prerequisites ARE 2631/2231 and ARE 2641/2241
The module introduces the learner to field of soil and water conservation. It gives a learner the basic knowledge on how man's activities and nature influence soil and water. Having completed the module, the learner is expected to be able to assess the dangers poised to soil and water resources and how to solve them.

ARE 3641/3241: Engineering drawing and design II
(Prerequisite ARE 3531/3131)
To introduce the learners to Engineering drawing and design of machinery parts, systems and simple buildings used in agriculture.

ARE 3632/3232: Farm workshop practices II
(Prerequisite ARE 3532/3132)
To give an understanding of the basic wood materials, and how to cut, measure, join and to work on the carpentry activities.

ARE 3633/3233Irrigation and drainage system design
Prerequisites ARE 3547/3147 and ARE 3548/3148
The module introduces the learner to the principles of design of irrigation and drainage systems. It also gives a learner the basic knowledge on irrigation development. Having completed the module, the learner is expected to be able to design small scale irrigation and drainage projects

ARE 3634/3234Postharvest processing technology
Prerequisite ARE 2641/2241
To impart knowledge and information of post-harvest processing machinery / equipment, and instrumentation systems used in crop processing. To expose learners to design and operational principles of processing technologies and storage facilities

ARE 3646/3246Farm power and machinery
Prerequisite ARE 2641/2241
The aim of the module is to introduce students to the different types of farm power that can be used in the farm and the various machinery used in the farm. This module introduces students on the types of farm power and machinery to use for farm operation.

ARE 3647/3247Rural and urban transport systems
Prerequisite ARE 3543/3143
The module introduces learners to the transport modes and systems. It covers aspects rural and urban transport system with emphasis on planning, traffic generation, management of transport systems and operations.

ARE 4521/4121Land use planning and management
Prerequisites ARE 3543/3143 and ARE 3548/3148
The module introduces learners to the land and its suitability depending on what that land can be used for. E.g. Agricultural purpose, industries, or any other means, different land types can be used for many purposes but the use of land depend on the type of soil. The module also introduces learners to land capabilities, land evaluation, planning possibilities, resource inventory evaluation, soil interpretation.

ARE 4522/4122Mechanization planning and costing
Prerequisite ARE 2641/2241
The module introduces students on the planning, and costing of mechanization in the farm. Type of machine to employ on the farm, depending on the size of the farm, population needs of the community, laborers, and financial status of the farmer.

ARE 4543/4143Entrepreneurship in rural development
To develop a good appreciation on how business are created and developed. Various types of agricultural oriented businesses will be identified for which the student can be self-employed.

ARE 4544/4144Research methods and experimental design
To review knowledge of basic statistical principles concepts and their application to experimentation. To familiarize the student with the Research methods and common statistical designs for experimentation particularly on the fields, as well as with data analysis and interpretation of same.

ARE 4526/4126Project and seminar presentation
Prerequisite ECS 1541/1141
To expose the student to a problem-solving approach to research in the area of agricultural and rural engineering. The student should be able to identify a research problem and adopt a scientific methodology to investigate the problem through appropriate data collection, data analysis and careful interpretation of the results of data analysis. To integrate knowledge and practice in rural engineering and development problems

ARE 4541/4141: Evaluation and management of irrigation and drainage systems
(Prerequisites ARE 3547/3147 and ARE 3633/3233)
The module introduces the learner to the principles of evaluating irrigation and drainage systems, and their management. Topics covered include evaluation of different irrigation and drainage systems, irrigation development, and management of irrigation and drainage systems, among others. Having completed the module, the learner is expected to be able to evaluate and manage small-scale irrigation and drainage projects.

ARE 4621/4221Selected topics in appropriate technology design
Prerequisite ARE 3634/3234
To expose learners to the current trend in technology design and developments. New technologies and methods are being invented on a daily basis. Budding engineers have to be kept abreast with these developments. Learners are to be equipped with principles of Computer Aided Design and Design of material handling structures/machines and selected crop processing technologies.

ARE 4622/4222Ergonomics and environmental safety
Prerequisite ARE 3646/3246
To develop a good appreciation on ergonomics principles and how they affect human safety and comfort at a particular work environment.

ARE 4641/4241: Animal traction
(Prerequisite ARE 2641/2241)
The module covers the role of animal traction as used in agriculture and rural settings. It covers aspects such as the selection of traction animals, harnesses, animal health and care, and use of animal in provision of tractive power.

ARE 4643/4243Rural water resource development
Prerequisite ARE 4541/4141
The module introduces the learner to the basic principles of hydrology. It gives a learner the basic knowledge on how to evaluate water demand and how to manage it especially for rural areas. The module also introduces the learner to the concept of water resource management and water quality management. Having completed the module, the learner is expected to be able to determine the water demand of a community, select a source of supply and manage the scheme.

ARE 4644/4244: Field practical/attachment
This module is intended to expose the student to a real-world working environment of graduates of the program. It is intended to expose the student to the following aspects of Agricultural and Rural Engineering: farm power and machinery, primary processing and handling of agricultural products, management, research, sales and marketing of agricultural tools and equipment, entrepreneurship, etc.

ARE 4645/4245: Project and mini dissertation
(Prerequisite ARE 4526/4126)
This is a final-year research/design project conducted by a student in any of the areas of specialization in Agricultural and Rural Engineering. It is carried out individually or in groups of student depending on scope and complexity of the problem being solved. The work culminates in a research project report that is defended by the student before a public audience and academic staff members in the department.

ARE 5531: Soil - Plant – Water Relationships and Irrigation
(Prerequisite ARE 3633/3233)
This is an honours module that is offered to graduates of the Bachelor of Agriculture. It covers application of elements of soil science, and irrigation and drainage.

ABE 1531/1131Technical Communication Skills
The module is designed to make the engineering students understand the basics and the importance of Technical Communication. It will enhance their ability in listening comprehension by making them understand the listening process and train them in professional speaking by imparting the knowledge of the various speech/presentation situations they have to face as technical students and as professionals later.

ABE 1532/1132Introductions to Agricultural and Biosystems Engineering
This module is to teach engineering students important skills that include technical problem solving and engineering design, ethical decision-making, the role of an engineer, teamwork, and communicating to diverse audiences.

ABE 1533/1133Physics I
The module is designed to make the engineering students understand the application of physics in engineering-applications of vibrational motion are developed and a basic description of the properties of elastic media given. The methods required to predict the performance of physical or engineering systems are demonstrated using examples drawn from various fields of science and engineering with emphasis on mechanics and vibrations, waves and optics.

ABE 1534/1134Chemistry I
This module is designed to equip the students with the knowledge of nature through building a basic knowledge of the structure of chemistry, analyzing scientific concepts and thinking critically, reviewing the importance and relevance of chemistry in our everyday lives and being able to utilize the methods of science as a logical means of problem solving.

ABE 1535/1135Pure Mathematics I
To understand advanced mathematical applications.

ABE 1536/1136Applied Mathematics I
Applied mathematics concepts.

ABE 1537/1137Engineering Drawing I
The aim of this course is to introduce students the basic concepts and the use of engineering drawing in the design and manufacturing field. The students acquaint with the basic knowledge and skills in engineering drawings and the capability to read and interpret blue prints for manufacturing.

ABE 1631/1231Introductions to Agricultural Sciences
This module is designed to enhance student perception of agriculture and its applications. This module covers principles in soil science; and plant and animal science and their products.

ABE 1632/1232Physics II
Prerequisite ABE 1536/1136
The module is designed to make the engineering students understand the application of physics in engineering-the description of electrostatics, magnetostatics and electromagnetic induction, together with a discussion of the properties of dielectrics and ferromagnetics, are presented

ABE 1633/1233Chemistry II
Prerequisite ABE 1534/1134
This module is designed to give student an introduction to general organic chemistry with an emphasis on natural aspects of the topic. Areas of concentration will include: organic nomenclature, structural theory and stereochemistry of aliphatic and aromatic compounds, and chemical reactions of fundamental importance to organic chemistry.

ABE 1634/1234 Earth and Environmental Science
The module is designed to make the engineering students understand the function of Earth's systems. Emphasis is placed on matter, energy, environmental awareness, materials availability, and the cycles that circulate energy and material through the earth system; and conservation.

ABE 1635/1235 Pure Mathematics
Prerequisite ABE 1535/1135
Mathematics applications and principles.

ABE 1636/1236 Applied Mathematics
Prerequisite ABE 1536/1136
Mathematics applications.

ABE 1637/1237 Fundamentals of Computing
This module is designed to help student understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc; understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries; be aware of the important topics and principles of software development and ability to write a computer program to solve specified problems.

ABE 2531/2131 Engineering Mathematics
Prerequisite ABE 1635/1235, ABE 1636/1236
To understand advanced mathematical applications.

ABE 2532/2132 Electrical Engineering
Prerequisite ABE 1632/1232
The module is designed to make the engineering students understand electrostatics, basic dc circuits, circuit simplification techniques, magnetic fields, ac circuit components, the dynamic of circuits, analysis of ac circuits, resonance, sinusoids and phasor, three phase power systems, operational amplifiers, transistors as amplifiers, diodes and transistors as switches

ABE 2533/2133 Thermodynamics I
Prerequisite ABE 1632/1232
The module is intended to give engineering students a comprehensive introduction to thermodynamics. It is designed as a module that will give students a necessary foundation for a comprehensive understanding of energy and other engineering systems. Energy systems are fundamental not only in energy production but in many other important aspects of engineering including the manufacturing of materials.

ABE 2534/2134 Solid and Structural Mechanics
Prerequisite ABE 1632/1232
The module is designed to teach the engineering student how to use the knowledge of mechanics in understanding the behaviour of structures. This module serves as an introduction to structural systems, and to methods of analyzing these systems under various loading conditions.

ABE 2535/2135 Mechanics of Machines I
Prerequisite ABE 1632/1232
The module is designed to make the engineering students understand the extension of classical mechanics and engineering applications. Plane dynamics, relative motion and forces in moving and accelerated reference frames; and it introduces students to general three-dimensional motion of a rigid body, inertia tensor and steady-state precession; and the laws of conservation of mass, momentum and energy.

ABE 2536/2136 Material Science and Engineering
Prerequisite ABE 1532/1132
The module is designed to make the engineering students understand the fundamentals of materials engineering, including bonding, crystal structures, and phase diagram; terminology, mechanical testing and behavior, heat treating, and processing of metals, ceramics, polymers, and composites; degradation of materials and criteria for materials selection.

ABE 2537/2137 Engineering Drawing II
Prerequisite ABE 1537/1137
The module is designed to make the engineering students understand the techniques and practices of engineering towards those elements and composites which are relevant to a particular field of engineering design and construction.

ABE 2538/2138 Fluid Mechanics I
Prerequisite ABE 1632/1232
The module is designed to make the engineering students understand the properties of fluids and hydrostatics pressure, basic principles of kinematics of fluid mechanics, relative equilibrium of liquids, flow through orifices, tubes, and wires.

ABE 2631/2231 Engineering Mathematics II
Prerequisite ABE 2531/2131
To advance concepts of Engineering Mathematics.

ABE 2632/2232 Computer Programming for Engineers
Prerequisite ABE 1637/1237
The module is designed to make the engineering students understand computer programming. The principal goal of the module is to teach basic computer programming concepts and apply them to computer-based problem-solving methods. The course stresses hands-on computer programming using MATLAB, a powerful high-level programming environment.

ABE 2633/2233 Engineering Surveying
Prerequisite ABE 2531/2131
The module is designed to give students full understanding of the nature of surveying data, including errors and the need for error control. Students will learn about surveying project fundamentals, particularly referencing systems, horizontal and vertical control, and topographic mapping and gain an understanding of the nature of calculations made with surveying data, methods of data recording, display, and storage.

ABE 2634/2234 Solid and Structural Mechanics II
Prerequisite ABE 2534/2134
The module builds on solid and structural mechanics I. The module gives an understanding of the design of multiply loaded complex structures with the addition of less than ideal boundary conditions. It reviews stress and strain in three dimensions, elastic and inelastic material behavior, and energy methods. It also covers use of the strength of materials approach to solving advanced problems of torsion, bending of beams and plates, buckling of columns, stress concentrations, and fracture mechanics.

ABE 2635/2235 Mechanics of Machines
Prerequisite ABE 2535/2135
This course is designed to enable students upon completion of the course to develop viable kinematic and dynamic models of real-world mechanisms and machines, and to describe and explain their dynamic behaviour during operation. The experience and reflective inquiry will enable students to obtain knowledge, skills and attitudes needed to understand and predict the dynamic behaviour of machinery and to relate these findings to their key design features and parameters.

ABE 2636/2236 Electronics
Prerequisite ABE 1632/1232
This module is designed to teach students the design of electronic circuits and systems, using commonly available devices and integrated circuits. The properties of linear circuits are discussed with particular reference to the applications of feedback; operational amplifiers are introduced as fundamental building blocks. Digital circuits are examined and the properties of the commonly available I.C. types are studied; their use in measurement, control and signal analysis is outlined.

ABE 2637/2237 Materials Processing
Prerequisite ABE 2536/2136
This module is designed to give engineering students a wide overview of materials and processes used to transform them. This module focuses on the classifying, properties, and processes of materials and the selection of those materials to be used in applications. Learners should be concerned with processes and materials used in metals, woods, plastics, ceramics, and composites.

ABE 2638/2238 Fluid Mechanics II
Prerequisite ABE 2538/2138
The module is designed to expand on the knowledge gained in Fluid mechanics I. A few of the more important topics will be taken to a moderately advanced level in this module. Students are taught the conservation principles of mass, momentum, and energy for fluid flow and how to apply the basic mathematical tools that support fluid dynamics.

ABE 3531/3131 Renewable Energy Resources and Technologies
Prerequisite ABE 1533/1133
The module is designed to make the engineering students understand the principles and utilization of solar (thermal and photovoltaic), hydroelectric, wind, geothermal, ocean thermal, wave, tidal and geothermal energy, as well as energy from biomass. The potential of using renewable energy technologies as a complement to, and, to the extent possible, replacement for conventional technologies are analyzed.

ABE 3532/3132 Thermodynamics II
Prerequisite ABE 2533/2133
This module builds on Thermodynamics I. The students will be asked to demonstrate their knowledge of the material covered in Thermodynamics I. Through the study of this course on thermodynamics the student will among others be able to sketch figures of systems and control volumes; sketch process diagrams for the processes occurring within systems and control volumes; develop the governing equations for conservation of mass, conservation of energy, and process relations for processes occurring in systems and control volumes.

ABE 3533/3133 Operations Research
Prerequisite ABE 1532/1132
This module introduces the methods of Operations Research to engineering students. It further emphasizes the mathematical procedures of nonlinear programming search techniques, introduce advanced topics such as probabilistic models (Markov chain & queuing theory) and dynamic programming.

ABE 3534/3134 Soil Science
Prerequisite ABE 1532/1132
This module is designed to give students of engineering an understanding of soil as a product of physical, chemical and biological processes acting over time on various rock and organic parent materials; the wide variety of soils resulting from soil-forming processes; the major criteria used for classifying these soils into the South African System of Soil Classification and the importance of appropriate management and land use practices to ensure conservation of this vital resource for forestry and agriculture.

ABE 3535/3135 Instrumentation
Prerequisite ABE 2636/2236
This module is designed to give the students of engineering an understanding of key aspects of current instrumentation and process control technology and upon completion enable them to carry out commissioning, calibration and maintenance of the typical devices used for measurement and control in industrial systems.

ABE 3536/3136 Engineering Hydrology and Meteorology
Prerequisite ABE 2632/2232
The module is designed to give students an understanding of engineering hydrology meteorology and applying the concepts in carrying out quantitative calculations relating to ground water and surface flows.

ABE 3537/3137 Statistical Methods and Experimental Design
Prerequisite ABE 1635/1235, ABE 2632/2232
The module is designed to give students of engineering a broad overview of experimental designs and statistical methods in order to plan their own experiments and to analyze existing data. This will enable them to select the appropriate statistical model for the design in question

ABE 3631/3231 Soil Dynamics and Mechanics
Prerequisite ABE 1532/1132
This module is designed to develop student technical competence in basic principles of soil mechanics and fundamentals of application in engineering practice; ability to identify common situations when the soil becomes a factor in an engineering or environmental problem; and capability of performing basic analytical procedures in these situations to obtain the engineering quantity desired given the formulae, tables, and the soil properties and understand their limitation.

ABE 3632/3232 Irrigation and Drainage Engineering
Prerequisite ABE 1532/1132, ABE 3536/3136
This module is designed to give students an understanding of the basic soil-plant-water parameters related to irrigation; the hydrologic cycle, principles and processes necessary to effectively manage water resources through well designed drainage and irrigation systems. Further to enable them apply appropriate techniques and analyses to the effective design of both irrigation and drainage systems; design, test, and analyze agricultural irrigation and drainage systems and their components.

ABE 3633/3233 Tractor Power Engineering
Prerequisite ABE 2635/2235
This module is designed to teach as much as possible about engines and tractors, with particular emphasis on design features, principles of operation, and maintenance for those going into industry, students will learn terminology, design features and principles of operation that will help them in a sales and/or service position for those going into farming, the course will help students decide which tractor to buy and how to get the most out of it.

ABE 3634/3234 Structural Design
Prerequisite ABE 2634/2234
The module is designed to develop skills in design of structures and an understanding of the overall structural concept, the choice of materials, and the concepts for details in a structure. Students will learn how to design and apply engineering principles to the design and analysis of structures used for agricultural and biological production. At the end of the course, the students are expected to know how to determine forces and displacements of determinate structures.

ABE 3635/3235 Process and Food Engineering
Prerequisite ABE 1631/1231
This module is designed to give train students in the engineering design, testing and analysis of unit processing operations employed in the food and biotechnology industries (sterilization, pasteurization, freezing/refrigeration, drying, evaporation, and fermentation, along with physical, chemical and phase separations); and to introduce students to the general approach for design and economic feasibility of an entire process line for a food, pharmaceutical or biotech manufacturing plant.

ABE 3636/3236 Principles of Microeconomics
This module is designed to introduce students to the basics of microeconomic analysis; develop students' ability to understand economic relationships; learn to use models to analyze current economic problems, particularly as they relate to the behavior of firms and individuals within a market economy.

ABE 3637/3237 Heat and Mass Transfer
Prerequisite ABE 3532/3132
This module is designed to teach the students the concept of energy balances and the three modes of heat transfer - conduction, convection, and radiation - are covered. Upon completing this course, the student will have an understanding of the mechanisms of heat transfer in physical systems and be able to calculate heat transfer rates and temperature distributions in practical engineering applications.

ABE 3638/3238 Rural Water Supply and Sanitation
Prerequisite ABE 3536/3136
The main goal and objective of this class is to study and understand aspects of rural water supply and sanitation. The course will discuss the relationship between water and sanitation and sustainability of rural water supply.

ABE 4000 Industrial/Field Attachment
Prerequisite Passed All Year 3 Modules
A period of attachment to an agro-industrial firm, a parastatal or a government department dealing with Environmental and Biosystems Engineering to gain practical knowledge, understanding and experience.

ABE 4531/4131 Rural Structures
Prerequisite ABE 2633/2233
The module is designed to teach students adequate tools to apply in the design criteria of rural buildings. The module considers both functional requirements deriving from the farm production scheme, and the effects of planning options on farm management, on environment and landscape.

ABE 4532/4132 Engineering Economy
Prerequisite ABE 2633/2233
This module is designed to teach the students economic theories and principles as applied to engineering decision making. It includes methods of compound interest, annual worth, and present worth, rate of return, benefit/cost ratio, capital allocation, depreciation, and risk analysis.

ABE 4533/4133 Built Environment Engineering
Prerequisite ABE 2633/2233
This course is designed to teach students the design and analysis of structures, and environmental modification of systems used in agricultural production. It will provide them with the fundamental knowledge necessary to understand structural and environmental control design parameters for agricultural buildings. It will train students

in the use of current computational software and computer data acquisition and control equipment used for analysis of structural design, environmental monitoring and control, and analysis of environmental control systems.

ABE 4534/4134 Soil and Conservation Engineering
Prerequisite ABE 1634/1234, 3534/3134
This module will teach students descriptive and quantitative hydrology that deals with the distribution, circulation, and storage of water on the earth's surface; discusses principles of hydrologic processes and presents methods of analysis and their applications to engineering and environmental problems.

ABE 4535/4135 Entrepreneurship and Product Development
Prerequisite ABE 4532/4132
This module will introduce engineering students to the relevant principles, processes, and practices of technical entrepreneurship. It will develop principles of entrepreneurship in a global economy and will include developing technology-based business plans for industrial firms, allowing students to apply in a real-world situation what they have previously learned about communications and engineering economics.

ABE 4536/4136 Design Project I
Prerequisite Passed All Year 3 Modules
The project is a practical assignment aimed at solving a particular engineering problem. It requires the application of knowledge gained in the courses up to the final year. It might deal with a problem in any of the five areas of specialization. This course shall be examined by coursework, oral presentation and report.

ABE 4537/4137 Project Planning and Management
Prerequisite ABE 3537/3137
The module is designed to help students master the principles of efficient project planning and control - needs analysis, work breakdown, scheduling, resource allocation, risk management, and performance tracking and evaluation - within the timeframe and cost projections stated in the overview section. Concepts and techniques will be developed by navigating through a recent textbook in project management and through a popular project management software package.

ABE 4631/4231 Design Project II
Prerequisite ABE 4536/4136
The project is a practical assignment aimed at solving a particular engineering problem. It requires the application of knowledge gained in the courses up to the final year. It might deal with a problem in any of the five areas of specialization. This course shall be examined by coursework, oral presentation and report.

ABE 4632/4232 Electrification
Prerequisite ABE 2532/2132
This module will help students understand electricity as a power source on the farm lighting, farm production and processing. They will learn how to plan the farm stead distribution system - demand load for farm buildings and workshops, central metering and distribution, capacity of main service; and care and maintenance of electrical farm installations and machines –hatcheries, milking machines, feed mills, etc.

ABE 4999 ECSA Outcome Portfolio
The ECSA portfolio is compiled by a student as s/he advances in the programme. It is a file kept by a student that shows all the academic work that a student undertakes throughout the programme.

ABE 4633/4233 Conservation and Precision Agriculture
Prerequisite ABE 3534/3134
The module is designed to help students to master comparative assessment of spatial variability in erosion prediction, sediment yield, C inputs and N use Initiate evaluation of precision conservation and agroecologic suitability.

ABE 4634/4234 Machinery and Mechanisation Management
Prerequisite ABE 3633/3233
This module will teach students how to manage mechanization - performance, costs, application, selection, and replacement of farm tractors and field implements; optimization of mechanized agricultural field operations.

ABE 4635/4235 Aquatic Machinery Engineering
Prerequisite ABE 3633/3233
Study of the principles and design methodology for aquatic machinery used for plant and animal production and processing and environmental control.

ABE 4636/4236 Transport Systems
Prerequisite ABE 3633/3233, ABE 4538/4138
This module is designed to teach students descriptors of transportation systems; allocation models; transportation as an industrial activity and public good; and transportation and spatial development, including the role of transportation in developing countries and in urban and regional development and problems involved in measuring the impact of transport investment.

ABE 4637/4237 Tractor Power and Machinery System Design
Prerequisite ABE 3633/3233
The module teaches students the design and specification of power and machine elements applied to agricultural, biological, land and water resources, or food engineering; fundamentals of power units, design of machine elements, power transmission, traction and stability, fundamentals of fluid power circuits, and an introduction to mechatronics.

ABE 4638/4238 Land Development Machinery
Prerequisite ABE 3633/3233
This module is designed to make engineering students understand the planning, designing, and constructing of earthworks. They will learn how estimate production rates, characteristics, operation techniques, and soil considerations for earthmoving equipment. They will acquire knowledge on how to select the most economical and effective equipment for each individual operation.

ABE 4639/4239 Minor Roads
Prerequisite ABE 3631/3231, ABE 4538/4138
The course will provide the students with a thorough understanding of the issues related to the application of planning and scheduling principles in the construction industry. It is intended to provide an in-depth discussion of some of the important scheduling issues faced by various agencies involved in the construction industry. The focus is on the development and planning of rural road, project financing, and rural project administration.

ABE 4623/4223 Watershed Management
Prerequisite ABE 3536/3136
This module is designed to introduce to students the principles of the watershed management approach and the value of working at a watershed; generate awareness about the importance of sustainable development and maintenance of natural resources; and develop human resource in watershed development and management.

ABE 4641/4241 Construction Management
Prerequisite ABE 4533/4133
The module teaches students critical elements in the development and planning of construction projects; project economic justification; alternative analysis procedures; cost estimation; site civil design; surveying; construction management; construction procedures for given projects.

ABE 4643/4243 Geo-Information System
Prerequisite ABE 2633/2233
The module is designed to make the engineering students understand the concepts, techniques and interdisciplinary application of GIS as an environmental decision-making tool. This module introduces methods of managing and processing geographic information. Emphasis will be placed on the nature of geographic information, data models and structures for geographic information, geographic data input, data manipulation and data storage, spatial analytic and modelling techniques, and error analysis.

ABE 4634/4234 Rural Extension and Technology Transfer
Prerequisite ABE 4532/4132, ABE 4535/4135
This module is designed to help students understand the genesis, meaning and concept of Agricultural Extension; know the various facets of Agricultural Extension, its objectives, principles and philosophy in reaching farmers and other clients effectively; know the process and steps involved in Agricultural Extension in transfer of technology; and identify and find out the meaningful extension strategy for realizing higher productivity and income of family community.

ABI 4631/4231 Hydrological Design of Reservoirs
Prerequisite ABE 3536/3136
This module teaches the students engineering applications of hydrologic science. Rainfall-runoff analysis. Lumped and distributed flow routing. Reservoir and river flood routing. Kinematic, diffusive and dynamic waves. Precipitation data analysis and optimal interpolation. Hydrologic design: risk analysis, hydroeconomic analysis, and analysis of uncertainty. Bayesian decision analysis. Design storms. Design flows. Hydrologic reservoir design. Watershed modelling applied to hydrologic design.

ABI 4632/4232 Design of Irrigation and Drainage Systems
Prerequisite ABE 3632/3232
The module is designed to give students an understanding of the fundamental principles of economic efficiency, soil physics and crop water use applied to the design of irrigation and drainage systems. It will enable them to develop design specifications for surface, sprinkler and trickle irrigation application systems and their operation; familiarize them with considerations for development of computerized analysis techniques for the design and operation of irrigation systems and enable them to develop design specifications for pumps and drainage systems.

ABI 4633/4233 Water Systems Engineering
Prerequisite ABE 3632/3232, ABE 3638/3238
This module is designed to equip the student with skills that are needed to enhance the ability of student to sustain adequate water supply facilities. It will give knowledge on the planning, design, construction, operation and maintenance aspects of water supply and sanitation programs and projects; and give them management skills with regard to sustainable water supply and sanitation facilities.

ABI 4634/4234 Groundwater Hydrology
Prerequisite ABE 3536/3136
This module will teach students fundamentals of subsurface flow and transport, emphasizing the role of groundwater in the hydrologic cycle, the relation of groundwater flow to geologic structure, and the management of contaminated groundwater. The class includes laboratory and computer demonstrations.

ABI 4635/4235 Surface Water Hydrology
Prerequisite ABE 3536/3136
This module will teach students specific knowledge in the field of water management in general and with respect to quantitative assessment of the surface water runoff in particular. Students will be trained on the development of their reasoning ability and critical reflection and on the writing of reports. Students are also trained in the use of up-to-date simulation models and GIS techniques and are hereby encouraged to develop their skills with respect to self-study.

ABS 4631/4231 Refrigeration and Air Conditioning
Prerequisite ABE 3635/3235
Air conditioning: heat sources, cooling loads, psychometrics, systems and equipment; design of ducts and fans. Elements of control. Interpretation of air conditioning data on psychometrics and mollier charts. Refrigeration: vapour compression, absorption systems industrial and commercial refrigeration, refrigerants and their properties, systems control, heat pumps, other forms of refrigeration. Applications of refrigeration and air conditioning principles and practice in environmental and Biosystems engineering.

ABS 4632/4232 Storage of Agricultural Products
Prerequisite ABE 3635/3235
The module is designed to teach students the requirements for storage of cereals, fruits, vegetables and potatoes. Analysis of the processes that occur during storage, ways to reduce losses. Selection of parameters and their impact on the quality characteristics of stored raw materials, storage and design for the type of raw material.

ABS 4633/4233 Processing Plant Design
Prerequisite ABE 3635/3235
This module is designed to train students in the engineering design, testing and analysis of unit processing operations employed in the food, pharmaceutical, and biotechnology industries (sterilization, pasteurization, freezing/refrigeration, drying, evaporation, and fermentation, along with physical, chemical and phase separations). Introduce students to the general approach for design and economic feasibility of an entire process line for a food, pharmaceutical or biotech manufacturing plant.

ABS 4634/4234 Food Engineering Systems
Prerequisite ABE 3635/3235
The module will give the student an understanding of the functional requirements and principles of operation of systems for handling and processing food and agricultural products. The student will become acquainted with the principles of handling and processing food and agricultural products. Particular emphasis will be given to the principles of operation of equipment used in the processing industry and the response of biological materials to these operations.

ABS 4635/4235 Dairy Technology
Prerequisite ABE 3635/3235
This module will introduce students to all methods of handling milk from production and consumption - including processing, packaging, storage, transport and physical distribution. They will learn principles of engineering that are employed in diary technology; and how to prevent spoilage, improve quality, increase shelf-life, and make milk palatable and safe for human consumption.

ABS 4636/4236 Post Harvest Technology
Prerequisite ABE 3635/3235
To impart knowledge and information of post-harvest processing machinery / equipment, and instrumentation systems used in crop processing. To expose learners to design and operational principles of processing technologies and storage facilities

ABS 4637/4237 Agro-Industrial Waste Management
Prerequisite ABE 1634/1234
Waste water – elements of waste water management, healthy and environmental implications. Principles of physical, chemical and biological process for waste water treatment. Solid waste – Elements of solid waste management, health and environmental implications, fundamentals of solid waste stud; generation rates, quantities, characteristics and composition. Hazardous waste - elements of hazardous waste management, health and environmental implications. Engineering principles applied to the control of hazardous waste generation, transport and disposal.

ABS 4638/4238 Packaging Technology
Prerequisite ABE 3635/3235
To understand the functional and protective aspects of packaging in food systems. The module includes aspect of packaging selection and its impact on the shelf-life of products, packaging design, packaging materials.

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

FST 2541/2141 Introduction to food science and technology
Food science and technology as a discipline. Status of food processing industry in South Africa, globalization of food Industries. Types of food: convenience, nutraceutical and organic foods. Human nutrition and food security. New food product development. Food quality, quality control and assurance in food industry. Food deterioration and preservation methods. Introduction to food microbiology, safety and traceability system. Food packaging and labeling. Food legislation. Food processing and the environment.
Practical work: Food science and technology as a career (SAAFoST video); processing of marula wine, baking technology, quality factors in food, sensory evaluation of processed foods, preservation of food, microbiological analysis of food and factory visits

FST 2621/2221 Introduction to food and nutrition
Nutrients and their categories: historical perspective in nutrition, functions of nutrients and nutrients categories, nutrient bioavailability. Brief discussion on digestion and absorption of nutrients: Carbohydrate, protein and fats. Vitamins and minerals, food fortification and enrichment. Nutrients quality of local foods and diets and weaning diets. Functional foods and health claims. Selection and formulation of balanced diets and weaning diets and recommended daily allowance. Nutrition in contemporary South Africa

FST 2642/2242 Fundamentals of postharvest biology and storage technology
Biological and environmental factors in the deterioration of intact plant tissues i.e. Fruits, vegetables, seeds, nuts and post-slaughter animal tissues. Post harvest technology procedures to extend shelf life – temperature management procedures, control of relative humidity, treatment to manipulate the environment e.g. packaging, controlled or modified atmospheres, control of air exchange or ventilation, etc. Techniques for fresh produce quality measurements. Practical work: Visit to packing houses

FST 2643/2243 Fundamentals of food preservation technology
Food contamination, spoilage and pH in foods. Food processing steps (materials handling, sorting, peeling, washing and thawing, homogenization, mixing, grinding, cutting and moulding). Food preservation methods: Combination of methods/ Hurdle technology. Heat treatment (blanching, pasteurization, and sterilization). Low Temperature (Refrigeration and freezing). Dehydration, concentration and intermediate moisture food (IMF). Types of chemical preservatives used in different food. Radiant and electrical energy. Fermentation, microorganisms and biotechnology. Advanced methods of food preservation.
Practical work: Enzymatic browning of fruits, determination of pH in fruit juices, demonstration of food processing equipment, blanching and pasteurisation of seasonal fruits and vegetables, preparation of syrup and canned fruits, freezing of seasonal vegetables, meat and fish products, dehydration of fruits & vegetables, preparation of fruit

bar, preparation of Jam, Jelly & squash, pickle preparation and fermented food products and visit to fruits and vegetable industry to see above operations.

FST 2644/2244 Food process engineering
Prerequisite PHY 1527/1127 and PHY 1627/1227
Basic principles of food process engineering, dimensions and units. Materials and energy balance, heat and mass transfer during food processing, thermal processing of foods, non-thermal processing of foods. Conversion unit operations: size reduction, mixing, separation processes: filtration, sedimentation, separation, sieving and distillation.
Practical work: Calculations on mass and energy balances, psychrometry, refrigeration and freezing. Drawings of appropriate equipment and processes

FST 3541/3141 Principles of human nutrition
Prerequisite FST 2621/2221
Principles of human nutrition: Food, nutrition and health. Guides for good food choices. The art of nutrition in a family meal environment, vegetarianisms, kosher and halaal foods. Digestion, absorption and metabolism. Nutrition in the life cycle: Maternal and infant nutrition. Growth and development and nutrition of the older adult. Diet therapy: Diseases of the gastrointestinal tract. Cardiovascular disease (CVD), salt, potassium and the control of blood pressure. Obesity and overweight. Diabetes mellitus. Food allergy and intolerance.

FSN 3542/3142Food chemistry I
Prerequisite BCM 2521/2121 and BCM 2522/2122
Chemistry of the major food components; including carbohydrates, proteins, Lipids and water. Chemical and nutritional aspects of food processing. Implications of different processing techniques on major food components. Functional properties of major food components. Modification of functional characteristics, Food analysis methodology.
Practical work: Activation and control of enzymatic reactions in fruits and vegetables; consequences of water migration on food quality; gelatinization-retrogradation in starch based foods (e.g., pudding, bread, and rice); initiation and control of non-enzymatic browning (e.g., pretzels, meat); and food emulsions (e.g., salad dressings, commutated meats products).

FSN 3543/3143Food microbiology
Prerequisite MBY 2521/2121
Microbiology of milk and milk products like cheese, butter, Ice-cream, milk powder. Microbiology of meat, fish, poultry and egg products. Microbiology of oil and fat based foods. Microbiology of Nuts, oilseeds, and dried legumes. Microbiology of fruits and vegetable products like jam, jelly, sauce, juice. Microbiology of cereal and cereal products like bread, etc. Practical work: Microbiological analysis of the above-mentioned products.

FSN 3081/3381Food commodity processing
Exercise aimed at producing value added food products from a food raw material of plant and animal origin using the principles and practices of relevant food processing technologies. The exercise involves the following components: planning, execution and reporting. Practical work: Food processing practical exercises should among others include processing technologies for processing and preservation of fruit and vegetable product, animal products, cereal based products, milk and dairy products, roots and tubes etc. One of the main objectives of this practical exercise is to develop and improve technological expertise and communication skills

FSN 3641/3241Product development and sensory evaluation of foods
Product development- A study on the consecutive steps followed in the development of a new food products, including packaging, factory hygiene and sanitation. Application of sensory evaluation, types of test and their specific functions. Selection and training of panel members, statistical analysis and interpretation of dat. Practical work: New food product development and aplication of different sensory evaluation methods

FSN 3642/3242Food chemistry II
Prerequisite BCM 2621/2221, BCM 2622/2222
Chemistry of the major food components; including carbohydrates, proteins, Lipids and water. Chemical and nutritional aspects of food processing. Implications of different processing techniques on major food components. Functional properties of major food components. Modification of functional characteristics, Food analysis methodology. Practical work: Food analysis.

FSN 3643/3243Quality management systems
Food quality systems charts, fundamentals of quality control, assurance and management with specific references to HACCP concept, Food standard and legislation, shelf life of foods and Food labeling. Food toxicants, food safety and food toxicants, food safety and food safety management tools. Practical work: New product development and application of HACCP plan in food products.

FSN 3644/3244 Cereal science and technology
Prerequisite FST 2642/2242 and FST 2643/2243
Science and technology of cereals. Sources of cereal products in the world. The physical chemical composition of the grain of cereals. Storage of cereals. Nutritional value of cereals. Composition and use of products of cereals. Milling and extraction process. Baking technology. Malting technology. Production of RTE (ready to eat) breakfast cereals. Pasta technology. Alternative uses of cereals. Practical work: Visits to mills, extraction and baking process. Laboratory analyses of components and products of grain. Experiments to determine the milling and baking quality of wheat. Rheological, chemical and baking tests of wheat.

FSN 4541/4141 Work integrated learning
Six months practical training in a relevant accredited food industry which covers at least two of the following: Research and product development, production/ processing/ manufacturing, quality assurance/ quality control, stock control and marketing

FSN 4641/4241 Fruit and vegetable technology
Prerequisite FST 2642/2242; FST 3542/3142 and FST 3642/3242
Fruit and vegetable technology: Overview of structure and composition. Post-harvest handling: storage, packaging and transport; extension of shelf life of fresh and minimally processed products. Preprocessing and / or preservation: canning, freezing, dehydration, concentration, fermentation, juice extraction, irradiation. Quality evaluation of processed products. Practical work: Practical execution of the process discussed above. Determination of preprocessing on losses, colour, and texture; inhibition of enzymatic browning, bottling, canning and pouches; juice extraction; freeze drying; factory visits; execution and reporting of a project on extended shelf life of a fresh juice or minimally processed products.

FSN 4642/4242 Meat and poultry products technology
Prerequisite FSN 3081
Animal food products. The red meat industry in South Africa. The composition of muscle tissue, the transformation from muscle to meat and the composition of meat. The slaughtering process and its effect on meat quality. The poultry and fishing industries in the RSA. The composition, processing, preservation and deterioration of poultry, meat and fish. Nutrition aspects of red and white meat. The use of eggs and preparation of egg products. Preservation and storage of meat. Meat processing and equipment. Decomposition of meat. Packaging. Quality characteristics of meat. Quality control and hygiene in the meat processing plant. Practical work: Actual manufacturing of different meat products such as sausages, salamis and related fermented meat products cured and emulsion type products.

FST 4643/4243 Food machinery
Prerequisite FST 2642/2242; FST 2643/2243; FST 3543/3143 and FST 3544/3144
General consideration of the nature and properties of material of construction, design features and functions of equipment used in unit operations in the food and Agro-processing industry. Equipment specification and some know-how of the construction of the equipment system. Information sources on food machinery / equipment.

FST 4081/4381 Research project
Small research projects in Food Science and Technology or related fields under the supervision of a research advisor.

DEPARTMENT OF FORESTRY

FRT 2141 Forest ecology and tree identification
Prerequisite BIO 1643/1243
Components of natural forests, woodlands and plantation forests. Factors influencing growth, management of forests and trees, interactions between and among components, alien invasive plant species, invasion process. Ecology and evolutionary processes influencing invasion by alien plant species. Mechanisms of adaptation by alien tree species, shrubs**.** Restoration of degraded ecosystems, habitats, environmental impact assessment and the FSC principles; Botanical concepts, tree/plant parts, the components of the Plantae Kingdom, characteristics of the gymnosperms and angiosperms, reproduction systems in forests trees. Biology and ecology attributes of the most important tree species in Southern Africa. Plant identification keys, collection of plant specimens, procedures for plant identification. Herbarium procedure

FRT 2144 Forest health and protection I
Prerequisite AGR 2141
Concept of disease in forestry, history of forest pathology, significance of forest diseases and wood production, effects of changes in forestry methods and human activities on development and spread of diseases, general life

cycles of forestry diseases belonging to the lower and higher fungi, history of forest entomology, significance of insect pests, insect pests and wood production, effects of changes in forestry methods and human activities on development and spread of insects, general life cycle of insects of forestry importance, main characteristics and significance of weeds.

FRT 2145 Introduction to forest economics
Prerequisites ECO 1141 and ECO 1241
The scope and nature of resource economics, the price mechanism and allocation of resources, supply and demand analysis, factor-factor and product-product relations, risk management and resource production system, Classification of forest goods, services; and forest service functions; review of economics principles in relation to forest resources; Theory of forestry investment analysis; and economic development in relation to natural resources,

FRT 2146 GIS and spatial analysis in forestry
Principles and operations of Geographic Information Systems (GIS) applied to Forestry and natural resources, field data collection for the creation of GIS maps and digital data sets, concepts of spatial analysis, integration of social and economic data to solve spatially related natural resources problems.

FRT 2241 Introduction to forestry engineering
Prerequisite None
Elementary mechanics, forces and acceleration. Newton's Laws of motion. Systems of forces, resolution, resultant and equilibrium for concurrent forces. Two dimensional force systems involving moments, vector, and equilibrium of forces. Behavior of engineering materials. Young's modulus yield strength, ultimate strength. Internal combustion engine principles. Logging terminologies. Operating principles and maintenance of tools and accessories for different forest operations. Tree cutting/felling principles, cross- cutting operation.

FRT 2243 Forest nursery management and propagation
Introduction to plant propagation (overview of technique to be covered, opportunities in the industry, naturally occurring propagation in a forestry succession); Propagation structures, nursery layout; Media and containers; Environment of plant propagation; Physiology of plant propagation; Stock plant management.; Seed technology (collection, handling and storage) Propagation by seed; Techniques of propagation by budding and grafting; Cultural considerations of nursery stock production; Nursery management (Nursery site selection, Nursery design and construction, Materials for tree nurseries, Container versus field growing, Weed control in nurseries, Production scheduling and Planning and record keeping); Pests and Diseases prevention and management; Cost of productio

FRT 2244 Forest valuation and investments
Prerequisite FRT 2145
The nature of forestry business. Definition of forestry business, overview of forestry business in South Africa, forestry business management concepts, marketing management, financial management, human resources management, entrepreneurship; definition and description, personal attributes of entrepreneurs, entrepreneurship opportunities in forestry business, review of forestry business case studies in South Africa, various types of business ownership (sole proprietor, partnership, corporation, etc.) advantages and disadvantages of the different types of business, the business plan, Forests and time value of money, basic concepts of compound interests, rate of returns (ROR), financial criteria, sensitivity analysis of reforestation costs, determination of rotation length, valuation of pre-commercial forest stands, valuation of immature stands using land expectation value (LEV) criterion, stumpage and delivered prices.

FRT 3141 Forest management
Concept of sustainable forest management; yield control and management for optimization of set objectives; application of mathematical models in solving forest management problems; elements of personnel management; systems approach to forest resources management and computer application in forest resources managemen

FRT 3142 Sawmilling
Prerequisite None
Log handling at the log yard: types of log yards, deterioration of floated and stored logs. Types of sawing machinery and layouts. Sawmill production planning: raw material requirements, sawing patterns and determination of sizes to be cut, personnel requirement, preventive maintenance, production costs, quality control (sawing accuracy and surface quality). Record keeping including recovery rates. Timber handling while in process including sorting. Saw doctoring: saw tightness and looseness, tensioning, sharpening and teeth setting. Timber drying: methods of drying, types of kilns and drying schedules. Timber preservation: preservation methods, types of preservatives, procedures, properties of treated wood, treatment specifications and quality control. Timber grading: rules, grading of softwood and hardwoods. Manufacturing and seasoning defects: raised, loosened, fuzzy grain; checks, cupping, warping, case hardening, collapse and honey combing.

FRT 3144 Forest resources assessment
Prerequisite None
Techniques for measurement of individual trees stand variables such as, calculating tree volume, estimating stem form and taper, as well as timber scaling a grading, growth and yield modeling, forest inventory. Basic techniques of surveys and sampling methods in natural and plantation forests. Fundamentals, principles and elements of remote sensing. Remote sensing and forest resource assessment: Principles of electromagnetic radiation, interaction with the atmosphere and vegetation cover; The multispectral concept, spectral resolution. Earth resource satellites (sensors and satellite). Visual interpretation, Digital Image processing. Vegetation mapping. Geographic Information System (GIS). GIS software and hard wares.

FRT 3242 Forestry policy
Different types and ownerships of forests and woodland resources in Southern Africa. The South African forest sector and the National Forestry Action Programme. Forest policy and the processes by which it is developed. State, local Government and tribal laws and regulations which influence forest management and use, how different policies, laws, Acts (e.g. Forests and Veld and Fire Acts, land reform Act) and regulations interact with socioeconomic and environmental factors to influence management and use of forests and woodland resources in Southern Africa.

FRT 3243 Silviculture I
Prerequisite None
The role, current status and challenges facing plantation forests in South Africa. Role and organizational issues of silvicultural practices for establishment, tending and harvesting of plantation forest South Africa. Factors affecting the sustainability of plantation forest management in South Africa. Criteria for selection of plantation sites, tree species, provenances and tree improvement practices through tree species & provenance trials, selection of plus trees, clonal orchards, progeny trials, seed stands, seed collection, handling, storage and nursery practices. Silvicultural techniques for site preparation, planting depth & spacing, blanking, weeding, pruning and thinning practices. Conservation of soil, water and biodiversity in plantation forests and afforestation in difficulty sites (steep slopes, arid lands etc)

FRT 3244 Forest health and protection II
Prerequisites None
The concept of forest health. Types and causes of forest fires, environmental and socioeconomic impacts of forest fires, forest fires behavior, theoretical approaches, strategies and practices to prevent forest fires (detection, management response to suppress), tools, equipment and organization set-up for fire-fighting. With regards to protection and maintenance of forest health and vitality the major focus will be on the following aspects: Major and emerging insect pests, disease wild animals of concern in Southern Africa plantation forests. Classification and identification of the most common insects pests. Identification of the most affected and resistant tree species and places, the causes of the outbreak, effective protection strategies & methods, phytosanitary measures. Principles of integrated pest management in plantation forests. International and local organization set-ups for collaboration in monitoring, evaluation and reporting of risks of outbreaks and impacts of insect pests disease pathogens and other major destructive agents of plantation forests in Southern Africa.

FRT 3245 Logging and roads
Prerequisite None
Principles and application of forest road location and surveying. Principles and application of forest road design, including; horizontal curves, vertical curves, cross-sectional information and structural design considerations. Terrain transport systems: manual, draught animal, semi mechanized and mechanized methods. Planning of logging operations: factors affecting logging and recommended environmentally sound harvesting systems. Harvesting Code of Practice. Logging production cost analysis. Road planning, design, alignment, construction and maintenance, types and layout of drainage structures. Felling methods and equipment. Moving wood to roadside on the ground. Best management practice and logging site impact. Cash flow analysis of logging business. Forestry certification – SFI, FSC, ISO, PEFC etc.

FRT 3246 Introduction to forestry extension
Origin and philosophy of forestry extension. Organization and structure of forestry extension in South Africa. Extension communication methods. Group dynamics and leadership roles in extension. Case studies and group discussions of extension methods in developing countries.

FRT 4241 Agroforestry
Prerequisite None
Agroforestry definition, concepts or hypotheses and main components. Agroforestry role (economic, social and environmental values); overview of the structure. Management and functioning of the most common agroforestry systems and practices in Southern Africa and worldwide. Component interactions in agroforestry systems and

practices, institutional organization set-up for agroforestry promotion. Research methods for identification and evaluation of promising agroforestry tree species and shrubs. Participatory tools for identification, monitoring and evaluation of performance of promising agroforestry practices/technologies in Southern Africa.

FRT 4242 Community forestry
Community forestry definition and meaning as adopted in different countries. Differences and similarities between Community forestry, agroforestry and urban forestry. Historical background of community based forestry or participatory forest resources management. The conceptual basis of the different community forestry arrangements. Principles and applications of common property management. Different Community forestry approaches/ strategies, practices and activities. The main aim/goal of community forestry in Southern Africa and elsewhere in the world. Review of experiences, perceptions and trends of Community forestry development in Southern Africa and elsewhere. Review of the potentials and limitations/challenges of community forestry e.g. in poverty alleviation, food security, prevention of deforestation, conservation of soil, water and biological diversity. Circumstances under which community forestry activities and or arrangements can be effective. Effects of globalization, poverty and conflict of interests. Community forestry agreements with local communities. Processes, tools and guidelines for Community forestry development

FRT 4243 Timber transportation and planning
The harvest planning environment (different types of harvest plans). Decision making framework for matching harvesting systems to the site. Steps in completing a harvest plan. Secondary log transport systems: objectives, methods and equipment: road, water, aerial and rail systems. Terminal operations and equipment. Road transport (truck configurations). Pulpwood and saw log truck selection. Planning in timber harvesting and transport. Timber transportation cost analysis. Work science and work study and their application in forestry.

FRT 4244 Silviculture II
Multiple values of natural forests and woodlands. Management goals and objectives of natural forest and woodland. Silvicultural basis for management of trees and forests which includes. Historical and current silvicultural activities in natural forests (management, research, inventory and monitoring). General silvicultural principles (interaction effects between ecology, biology attributes of trees with abiotic and biotic environmental conditions, human activities and needs. Silvicultural systems and practices; functions of silvicultural systems and practices. Silviculture of the major indigenous tree species in natural forests and woodlands of Southern Africa; forest harvesting systems and regeneration processes/practices. Constraints and opportunities of natural regeneration and enrichment planting of major indigenous trees in Southern Africa. Factors influencing the implementation of various silvicultural systems and practices, adaptation process of silvicultural systems to suite local conditions e.g. for restoration of degraded natural forests and woodlands in rural areas of Southern Africa

FRT 4245 Forest conservation
Factors leading to loss and or degradation of forest resources. Forest conservation role and scope. Principles and criteria for selection and development of a network of forest conservation areas. Sustainable forest management criteria and indicators and their role in planning for conservation of forests and woodlands in Southern Africa; forest conservation categories. Applicability of the IUCN categorization of conservation status to Southern Africa forests and woodlands, approaches for selection of forest conservation sites, steps in preparation of forest conservation management plan. Limitations and sound ecological and socioeconomic basis for setting conservation priorities and targets; forest conservation activities. Surveying, monitoring and evaluating effectiveness of forest conservation activities; institutional arrangement for forest conservation in Southern Africa.

FRT 4081/4381 Project and seminar presentation
The framework for research proposal. Research Background and research problem statement. Topic identification. Research proposal writing. Research objectives and Hypothesis. Theoretical framework and review of literature. Conducting an experiment. Data analyses and interpretation.

Data collection techniques and Data analysis. Presentation of Research Results. Project Research report writing. Seminar on Research Findings.

WIL 4182 Forest management planning
Biophysical and socio-economic data collection and analysis. Indigenous rights issues. Land management goals. Regulatory context. Participatory approaches to monitoring and management. Integrative strategies. Preparation of forest management plans for a specified plantation or natural forest area. The plan must contain sections on description, registration, directives, and prescriptions of different operations. Preparation of annual plan of operations (APO).

DEPARTMENT OF HORTICULTURAL SCIENCES

HRT 2541/2141 Principles of horticultural crops production
Prerequisite AGR 1631/1231
This module is designed to introduce learners to fundamental principles and practices underlying successful production of horticultural crops. The module will explore the basic plant structure, growth and development of horticultural plants from practical and scientific approaches; environmental effects, basic principles of propagation, nutrition, pruning. It provides an aesthetic appreciation of how plants affect us in our daily lives.

HRT 2641/2241 Plant propagation
This module deals with the principles, practices and techniques followed in sexual and asexual plant multiplication. Seed production, seed harvesting, postharvest seed handling and storage will also be covered. Learners will be provided with the opportunity to practice different techniques in plant propagation; crop micropropagation, cutting propagation, stem, leaf and root cuttings; propagation by layering, grafting techniques, and propagation by specialized plant structures.

HRT 3531/3545/3145 Ornamental horticulture
Prerequisite HRT 2541/2141
This module exposes learners to identification, classification, selection, adaptation, production techniques and utilization of common ornamental and native plants in South Africa and the world, relating to decorative purposes for indoor and outdoor living. Learners will gain knowledge in the production of cut flower plants, flowering pot plants, and flowering plants for outdoor.

HRT 3533/3133 Plant tissue culture
This module presents to the learners principles of plant tissue culture and micropropagation. It covers the totipotency concept, laboratory requirements and set up for tissue culture, role and composition of tissue culture media and pathways of plant regeneration by tissue culture. Characteristics of callus and suspension cultures, somatic embryogenesis, genetic stability and artificial seeds, organogenesis and meristem culture will be covered. Case studies on successful micropropagation of horticultural crops are included

HRT 3534/3134 Citriculture (citrus production)
Prerequisite HRT 2541/2141
This module deals with world citrus production and marketing. Topics covered include, history, botany, classification, distribution, cultivation, varieties and rootstocks, soil and climate suitable for citrus production, propagation, layout and planting new citrus orchard, and management practices of established citrus orchard. The module will emphasize the relationship of environment to species, cultivar, and rootstock selection. Recent significant developments in plant breeding and cultural practices will also be covered.

HRT 3544/3144 Controlled environment horticulture
Prerequisite HRT 2541/2141
This module exposes learners to controlled environment technology in horticulture. Topics covered include; concepts and systems of environmental control, commercial applications, relative merits and demerits of controlled environment production systems. Learners will be introduced to the cropping and production of high value horticultural crops in plastic tunnels, shade houses and greenhouses. Other topics covered are; types of structures for protected cultivation and their characteristics, greenhouse design and site considerations, greenhouses and their operations, plant culture in hydroponics, plant nutrition in soil-less culture, Hydroponics media and Aeroponics.

HRT 3631/3231 Olericulture
Prerequisite HRT 2541/2141
This module deals with a comprehensive study of principles and practices related to the production of major and minor vegetables of South Africa, Africa and world in relation to production practices, nutritional value and quality characteristics. Special emphasis will be placed on growing crops for markets. It includes the following families Salicaceae, Asparagaceae, Asteraceae, Brassicaceae, Chenopodiaceae, Fabaceae, and Gramineae

HRT 3642/3242 Turfgrass and landscape horticulture
Prerequisite HRT 2541/2141
This module deals with Turfgrass production and management, comparisons of turfgrass for recreational, landscape uses and covers area. Other topics covered are: growth, characteristics, methods of propagation, and basic management requirements, including control of important pest and diseases, turfgrass identification and adaptation, establishment and maintenance of high quality turf areas. Learners will be briefly introduced to application of the principles and elements of design to planning and developing residential landscape designs.

HRT 3643/3243 Miscellaneous Horticultural Crops (Temperate fruit and nut trees production, Spices, herbs, beverages and medicinal crops)
Prerequisite HRT 2541/2141
This module deals with temperate fruits and nut trees production in summer rainfall areas of South Africa. Topics include climatic and soil conditions, cultural management, pruning and training. Physiological principles involved in growing temperate fruits in marginal environment of the sub-tropics will be covered. Emphasis will be on selection of low chilling requirement cultivars, rootstocks and methods of breaking dormancy in temperate trees. This module deals with history, origin, classification, cultural practices in production of major spices, herbs, beverages and medicinal plants. It discusses ecology, factors affecting growth and development, crop management and cultural practices, pest and disease control, harvesting, sorting, packaging storage and marketing. Their contemporary uses will also be discussed.

HRT 4642/4242 Agriculture biotechnology
Prerequisite BCM 2621/2221 and BCM 2622/2222
This module deals with organization of genetic material, gene structure, expression and transmission. It covers topics in control of gene expression, structure and properties of DNA, DNA replication, protein synthesis and principles of gene cloning. Learners are introduced to recombinant DNA technology, concept, and basis of biotechnology and application of biotechnology in agriculture and crop improvement.

HRT 4643/4243 Tropical and subtropical fruit and nut trees
Prerequisite HRT 2541/2141
This module is designed to introduce learners to current principles and practices in production of fruit and nut trees of economic importance in tropical and subtropical areas. Topics covered include; history, botany, classification, taxonomy, origin, adaptation, cultural practices, climate, producing regions of the world, varieties grown, rootstocks and factors for successful cultivation and utilization of these crops. Emphasis is on application of modern science and advanced technologies in the production of fruit crops for fresh and processing industries.
HRT 4644/4244 Postharvest physiology of horticultural crops
Prerequisite AGR 3541/3141
This module is designed to provide learners with knowledge of physiological changes associated with storage and handling of horticulture produce. It covers current practices used in extending shelf-life, basic and applied laboratory analysis techniques, produce deterioration, senescence of perishable crops, properties of ethylene, biosynthesis and mechanism of action of ethylene, and its role in fruit ripening. Other topics covered include; manipulation of postharvest physiological processes to enhance quality of fresh produce, waxes and edible coatings, postharvest chlorination, cooling and pre-cooling methods, and curing root, tuber and bulb crops.

HRT 4081/4380 Project and seminar presentation
Prerequisite RME 3648/3248
Independent research under academic adviser culminating in an oral and research report. Research topic related to horticulture. Students should demonstrate good practice in using skills and knowledge acquired during the programme and follow dissertation guidelines as laid down by the department.

DEPARTMENT OF AGRONOMY AND CROP SCIENCE

AGR 1631/1231 Agriculture and humankind
Prerequisite None
Origin and development of agriculture through the ages. Global agricultural profile; output of major agricultural products. Branches of agriculture. Career opportunities in agriculture. Role of agriculture in socio-economic development. History and development of agriculture in South Africa. Climate and soils of South Africa. Factors affecting agricultural production in South Africa. Agricultural organisations and research institutions in South Africa. Farming systems of South.

AGR 2641/2241 Principles of plant production
Prerequisite AGR 1631/1231
Historical perspective of crop production; when and why crop production began. Classification of crop plants; agronomic, botanical, life-span, special purpose etc. The environment in relation to crop production. Cultural practices. Introduction to climate change. Principles and practices of crop protection. Crop improvement and seed production. Cropping systems. Principles of irrigation

AGR 3541/3141 Principles and applications of plant physiology in plant production
Prerequisite BIO 1542/1142 and BIO 1643/1243
Role of crop physiology in food production. Review of the physical characteristics of tropical and sub-tropical environment. Review of plant cell structure and physiological functioning. Plant water relations. Photosynthesis. Respiration. Mineral nutrition of crop plants. Plant growth regulators. The physiology of yield production.

AGR 3641/3241 Introductory plant breeding and seed production
Prerequisite GEN 1641/1241 and AGR 3541/3141
History of the development of plant breeding. Genetic basis of plant breeding. Tools of the plant breeder. Methods in plant breeding and their application. Germplasm resources and conservation. Seed production of crop germplasm. Intellectual property rights.

AGR 3531/3131 Management of natural and cultivated pastures
Prerequisite AGR 2641/2241
Natural pastures: Introduction – veld and pasture management terminologies in Southern Africa
Plant succession – primary and secondary succession – process involved in plant succession- limiting factors. Pasture ecology – the grass family – taxonomy of grasses- morphology of grasses. Grazing value and ecological status of grasses – factors that determine the ecological status of grasses and variation in ecological status of grasses and variation status. Vegetation types of Southern Africa – Grassland, Savanna, Fynbos, Karoo, and Forest. Fire ecology – fire terminologies – characteristics of fire behavior – ecological effects of fire – principles of fire management. Monitoring vegetation change and assessing veld condition – the concept of the vegetation change and veld condition. Different methods of assessing veld condition. The animal/plant interaction – effects of animals on plants – defoliation – species selective grazing – area selective grazing – the use of veld by wild ungulates. Grazing management principles and practices – types of grazing management – resting veld burning as management practice in livestock production- bush encroachment. Veld rehabilitation of denuded and eroded. Establishment of cultivated pastures: The role of cultivated pastures in South African farming Pasture establishment. Selection of pasture species according to soil, climate and livestock

AGR 3533/3133 Bio-energy crops: Agronomy and postharvest processing
Prerequisite AGR 2641/2241
History/origin. Distribution. World production. Economic importance. Botany. Ecological requirements. Crop improvement. Field management. Harvesting. Post-harvest handling

AGR 4632/4232 Agronomy of selected field crops
Prerequisite AGR 2641/2241; AGR 3641/3241 and PPR 3541/3141
History/origin. Distribution. World production. Economic importance. Botany. Ecological requirements. Crop improvement. Field management. Harvesting. Storage processing

AGR 4081/4381 Project and seminar presentation

PPR 3541/3141 Introduction to plant protection
Prerequisite AGR 2641/2241
Diversity and role of insect and plant pathogenic microorganisms in natural ecosystems and agroecosystems. History of plant pathology and agricultural entomology. Pests and diseases and their effects on plant production. Concept of disease in plants: infectious and non-infectious diseases. Etiology of disease causing agents. Disease cycles and disease epidemics. Life cycles of some diseases of economic importance. History of agricultural entomology. Economic and ecological changes that cause insects to become pests. General development of insect populations and economics of pest control. Life cycles of some insect pests of economic importance. Significance of weeds in crop production. Categories of weeds. The Law and weeds in South Africa.

PPR 3631/3231 Agricultural entomology
Prerequisite PPR 3541/3141
Economic importance of insects. Categories of pests and causes of pest outbreaks. Sampling and its importance in pest management. Insect Orders of economic importance: biology and life histories. Principles of insect pest control: insect ecology and behavior. Practices of insect pest control. Cultural, biological, genetic and legislative control. Plant resistance to insects. Chemical control: formulation, safety and application. Insecticide resistance and its management. Pesticide safety and application. Pesticide registration. Integrated pest management. Examples of pest control in annual and perennial crops

PPR 3641/3241 Weed science
Prerequisite PPR 3541/3141
Definition and classification of weeds. Plant succession and development of weeds in cropping systems. Impact of weeds on crop production. Weed biology. Weed ecology. Nature of weed-crop interactions. Management of weeds. Herbicides: classification criteria and working classification. Herbicide-plant interactions. Herbicide-soil interaction. Herbicide resistance and how it is managed

PPR 4641/4241 Plant pathology
Prerequisite PPR 3541/3141
Plant defence mechanisms. Types of diseases and disease symptoms. Diagnosis of plant diseases

Non-infectious diseases. Disease causing agents: classification and biology of fungi, nematodes and bacteria. Viruses: classification and replication strategies. The disease triangle and factors affecting infection and disease development. Disease cycles. Development of disease epidemics
Impact of plant diseases on crop production: historical and current examples. Etiological and epidemiological principles in disease control. Disease and crop loss assessment. Examples of plant diseases management in different cropping systems.

DEPARTMENT OF SOIL SCIENCE

SSC 2541/2141 Introduction to soil science
Soil: Definition and concepts, soil profile, horizons. Soil forming factors and processes. Physical properties of soils – Texture, structure, density, colour, porosity. Chemical properties of soils – cations and anions, CEC, Alkalinity and acidity, pH and nutrient availability. Biological properties of soils – classification of soil biota. Effects of soil organisms on soil fertility, detrimental effects of soil organisms. Organic matter – origin, composition, and influence on soil properties

SSC 3542/3142 Soil chemistry
Prerequisite SSC 2541/2141
Soil Colloids: General properties and types of soil colloids, Fundamentals of layer silicate structure, Mineralogical organization of silicate clays, Structural characteristics of nonsilicate colloids, Genesis and geographic distribution of soil colloids, sources of charges on soil colloids, Adsorption of cations and anions, Cation exchange reactions, Cation exchange capacity, Anion exchange, sorption of organic compounds, physical implication of swelling-type clays. Distribution of ions near charged particles, Soil solution, Oxidation and reduction reactions in soils. Soil Acidity, Alkalinity, and Salinity: The process of soil acidification, causes of alkalinity: High soil pH, Role of aluminium in soil acidity, Buffering of pH in soils, Determination of soil pH, Human induced soil acidification, Biological effects of soil pH, Raising soil pH by liming, Alternative ways to ameliorate the negative effects of soil acidity, Lowering soil pH, Development of salt-affected soils, Measuring salinity and sodicity, Classes of salt affected soils, Water quality considerations for irrigation, Reclamation of saline soils, Reclamation of saline-sodic and sodic soils.
Practicals: Equipment and Methods for Soil Preparation and soil preparation. Determination of hygroscopic water content. Determination of pH and EC. Adsorption and ion exchange exercises. Organic carbon analysis.

SSC 3543/3143 Pedology
Prerequisite SSC 2541/2141
Soil forming factors and processes. The effect of soil forming factors to soil morphology and on soil physical, chemical and biological properties. Physical and chemical weathering processes of rocks and minerals and their products. Pedogenesis i.e. soil forming processes (sulfurization, salinization, calcification, eluviation, illuviation, Podzolization, gleization, erosion, leaching, alkalization, dealkalization, calcification, decalcification, braunification, and deposition. Soil morphology: development of A, B, C and other soil horizons. Effects of soil organisms on soil fertility development (termites). Soil spatial variability in the field

SSC 3544/3144 Soil physics
Prerequisite SSC 2541/2141
Soil composition. Soil water and energy measurement. Specific surface area. Soil structure and aggregation. Flow of water in saturated soils. Flow of water in unsaturated soils. Infiltration. Gas transport in soil (Soil Aeration). Heat transport in soil (Soil Temperature). Evapotranspiration

SSC 3641/3241 Soil survey, classification and mapping
Prerequisite SSC 2541/2141
Soil forming factors and processes. The effect of soil forming factors to soil morphology and on soil physical, chemical and biological properties. Pedogenesis i.e. soil forming processes. Soil morphology: development of A, B, C and other soil horizons. Soil spatial variability. Soil survey, soil classification and mapping (using different systems). Remote sensing and GIS. Practical will be based on the influence of litho sequences, Chronosequence, rainfall sequences, temperature sequences, bio-sequences, and toposequence. The field trip is done in Limpopo. Mpumalanga, and Kruger National Park Soil classification (S.A)

SSC 3642/3242 Soil microbiology
Prerequisite SSC 2541/2141
Major types and groups of soil organisms, their ecological relationships and functions in the soil.
Conditions affecting the growth of soil microorganisms. Role of microorganisms in synthesis and decomposition of soil organic matter. Role of microorganisms in nutrient cycling (N, P, S). Microbial interactions in the soil. Biological nitrogen fixation. Mycorrhiza. Rhizosphere

Practicals: Setting of Winogradsky's column. Enumeration of soil microorganisms (bacteria), actinomycetes, fungi by standard plate count. Estimation of soil microbial activity by CO_2 evolution. Mycorrhiza. Biological nitrogen fixation.

SSC 4641/4241 Soil fertility and plant nutrition
Prerequisite SSC 2541/2141; SSC 3542/3141
Soil fertility definition and concepts (past and present). Total versus available nutrients. Soil and fertilizer Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sulphur. Trace elements and factors affecting their availability. Soil organic matter. Soil fertility evaluation and management practices. Plant absorption of nutrients and factors affecting it. Role of various nutrients in plant growth.

SSC 4644/4244 Land evaluation
Prerequisite SSC 2541 /2141
Soil mapping and soil survey. Map scales. Air photography. Interpretation of a soil map. Land evaluation, principles and procedures. Land evaluation systems. Data sources for Land evaluation
Remote sensing for Land Evaluation. Land use planning. GIS

SSC 4645/4245 Soil, water and plant analysis
Prerequisite SSC 2541/2141; SSC 3542/3142
Soil sampling – aims and procedure. Sample preparation, Extraction. Underlying chemical principles relating to the analyses of – N, P, K, Ca, Mg, Org.C, micronutrients, pH, EC, texture
Interpretation of soil analysis results. Recommendations based on the interpretation of soil analysis results. Water sampling – aims and procedures. Preparation for analysis and analysis for various nutrients/elements. Interpretation of water analysis results based on the proposed usage. Recommendations based on the interpretation of water analysis results. Plant tissue sampling – aim, and procedure (which part and when to sample). Sample handling and storage, grinding and ashing. Underlying chemical principles relating to the analyses of – N, P, K, Ca, Mg, micronutrients. Interpretation of plant tissue analysis results. Recommendations based on the interpretation of plant tissue analysis results Practical: Analysis of soil samples. Analysis of water samples. Analysis of Plant tissue samples.

SSC 4081/4381 Project and seminar presentation
Prerequisite RME 3648/3248
Independent research under academic adviser culminating in an oral and research report. Research topic related to soil science. Students should demonstrate good practice in using skills and knowledge acquired during the programme and follow dissertation guidelines as laid down by the department.