COLLEGE OF AGRICULTURE, ENGINEERING AND SCIENCE

HANDBOOK FOR 2020

Deputy Vice-Chancellor and Head of College
Professor AT Modi
BScAgric (UFH), MScAgric (Natal), PhD (OSU)

Dean and Head of School of Agricultural, Earth and Environmental Sciences
Professor Muthulisi Siwela *(Acting)*
BScHons (NUST), MSc, PhD (Pretoria)

Dean and Head of School of Chemistry and Physics
Professor RS Robinson
BScHons, PhD (Rhodes)

Dean and Head of School of Engineering
Professor G Bright
PrEng, BScEng, MScEng, PhD (Natal), MBA (UKZN)

Dean and Head of School of Life Sciences
Professor AO Olaniran
BScHons, MSc (OAU), PhD (UKZN)

Dean and Head of School of Mathematics, Statistics and Computer Science
Professor DE North
BScHons, MSc, PhD (Natal)

Dean of Research
Vacant

Dean of Teaching and Learning
Professor N Chetty
BScHons (Natal), PhD (UKZN)

Director: Professional Services
Mr MA Tufts
BScHons, MSc (Stell.)

Manager: Academic Services
Ms S Govender
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Contents

STAFF OF THE COLLEGE OF AGRICULTURE, ENGINEERING AND SCIENCE

School of Agricultural, Earth & Environmental Sciences
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Professor M Siwela

Senior Professors
MD Laing *BScHons, PhD (Natal)*   Plant Pathology
B Maharaj *BPaed, BAHons, MA (UDW), PhD (Natal), FSSAG*   Geography

Professors
TK Birke *BSc Geology, MSc Structural Geology (AAU, Ethiopia), PhD (Paris, France)*   Geological Sciences
EJM Carranza *BScGeol (AdU), MScMinEx (ITC), PhD (TUDelft), Pr.Nat.Sci., RPGeo, FAIG, FAusIMM, FAAG, FSEG*   Geological Sciences
M Chimonyo *BScHons, MSc, PhD (Zimbabwe)*   Animal & Poultry Science
AN Green *BScHons (Natal), MSc, PhD (UKZN)*   Geological Sciences
TR Hill *BScHons, PhD (Rhodes), PGDE (Rhodes)*   Geography
P Mafongoya *BScHons (Zim), MSc AppPlant Sci, MScAgriDev (London), PhD (Florida)*   Rural Agronomy & Dev
AT Modi *BScAgric (UFH), MScAgric (Natal), PhD (OSU), FSASCP, SFGreenMatter*   Crop Science
O Mutanga *BAHons (Zimbabwe), MSc, PhD (Wageningen-ITC)*   Geography
S Proches *DiplBiol, MSc (Bucharest), PhD (UDW)*   Geography
HA. Shimelis *BScAgric (Alemeya), MSc (Wageningen), PhD (Free State)*   Crop Science
E Wale Zegeye *BScAgric (Alemaya), MScAgric (Wageningen), PhD (Bonn)*   Agricultural Economics

Associate Professors
LJS Baiyegunhi *BAgricHons, MSc (ABU, Nigeria), PhD (UFH)*   Agricultural Economics
I Bertling *DiplAgrBiol, DrScAgr (Hohenheim)*   Horticultural Science
JM Chitja *BScAgric, MSocSci (Natal), PhD (UKZN)*   Food Security
MB Demlie *BSc, MSc (Addis Ababa), Dr rer nat (Ruhr), PrSciNat*   Geological Sciences
M Gebreslasie *BA (Asmara), MSc (UKZN), PhD (UKZN)*   Geography
A Gubba *BSc (Zimbabwe), MSc (London), PhD (Cornell)*   Plant Pathology
SM Kassier *PGDip Hosp Diet, BScDietHons (Stell), MScDiet (UKZN), PhD (UCT)*   Dietetics & Human Nutrition
S Kebede Gurmessa *BSc Geology, MSc Hydro (AAU Ethiopia, PhD Hydrology (Avignon, France)*   Hydrology
L Magwaza *BScAgric (Natal), MScAgric (UKZN), PhD (Stellenbosch)*   Crop Science
P Muchaonyerwa *BScAgricHons, PhD (Zimbabwe)*   Soil Science
M Mudhara *BScAgricHons, MPhil (Zimbabwe), PhD (Florida)*   Agricultural Economics
IV Nsahlai *BScMaitrise (Yaoundé), PGDip, PhD (Reading)*   Animal and Poultry Science
J Odindi *BEnviStHons (Kenyatta), BScHons, MPhil (UFH), PhD (NMMU)*   Geography
J Sibiya *BScAgricHons (Zimbabwe), MS (OSU), PhD (UKZN)*   Plant Breeding
M Siwela *BScHons (NUST), MSc, PhD (Pretoria), PGDip Mgt (UKZN), PrSciNat*   Dietetics & Human Nutrition
S Tesfay *BSc (Asmara), MSc (UKZN), PhD (UKZN)*   Horticultural Science
SH Worth BScAgBus (Fresno), MAgricMgmt (Natal), PhD (UKZN)Agric. Extension & Rural Resource Management

Senior Lecturers
O Bass *BSc (UCT), BScHons (Natal), PhD (UCT)*   Geography
M Ciacciariello *DVM (Buenos Aires), PhD (Natal)*   Animal & Poultry Science
A Clulow *BScHons, MSc , PhD (UKZN)*   Agrometeorology
MAG Darroch *BScAgric, MScAgric (Natal)*   Agricultural Economics
SA Desai *BPaed (UDW), MA, PhD (UKZN)*   Geography
SRD Ferrer *BScAgric, PhD (Natal)*   Agricultural Economics
J Finch *BScHons (Natal), MSc (UKZN), PhD (York)*   Geography
EDC Hingston *BScHons (USL), MSc (Natal), PhD (Leeds)*   Geological Sciences

R Lottering *BScHons, MSc, PhD (UKZN), PrSciNat*   Geography
A Mditshwa *BScAgric (UFH), MScAgric (UKZN), PhD Agric (Stellenbosch)*   Horticultural Science
A Nel *BEcon Hons (Rhodes), DPhil (Otago)*   Geography
SN Njoya *BA (Yaoundé), MEnvMgt (Natal), PhD (UKZN)*   Geography
AO Odindo *DipAgric (Egerton), MSc (Aberdeen), PhD (UKZN)*   Crop Science
K Pillay *PGDipDiet, BScDietHons (Natal), MScDiet, PhD (UKZN)*   Dietetics & Human Nutrition
S Pillay *BSc (UDW), BScHons (Unisa), MSc (South Carolina), PhD (Natal), HED (Unisa)*   Geography
PE Shanahan *BScAgric, PhD (Natal)*   Plant Breeding
EJJ Sieben *MSc (Wageningen), PhD (Stellenbosch)*   Geography
NC Tyler *BScAgric, MScAgric (Natal), PhD (UKZN), MEd (UKZN)*   Animal & Poultry Science
JD Woodard *MSc, PhD (Turku)*   Geological Science
KS Yobo *BScHons, MSc, PhD (UKZN)*   Plant Pathology

Lecturers
F Ahmed *BA (UDW), HBA, MA, PhD (UKZN)*   Geography
C Biggs *BScBioSc, BScDietHons (Natal), PGDipHospDiet (Free State), MSc, PhD (UKZN)*   Dietetics & Human Nutrition
N Buthelezi *BSc, BScHons, MSc (UKZN)*   Soil Science
K Caister *BScDiet, PGDipDiet (Natal), MAgric, PhD (UKZN)*   Agric. Extension & Rural Resource Management
KT Chetty *BScHons (Natal), MSc (UKZN)*   Hydrology
L Govender *BScDiet, PGDipDiet, MScDiet (UKZN)*   Dietetics & Human Nutrition
WW Hastie *BSc Hons, MSc, PhD Geology (UKZN)*   Geological Sciences
L Hoyer *BSc, BScHons, PhD (UKZN)*   Geological Sciences
PK Mavimbela *BSc Hons, MSc (UP)*   Geological Sciences
NC Mbili *BSc Hons, MSc (UKZN), PhD (Stellenbosch)*   Plant Pathology
S Misra *BSc, MSc, PhD (Calcutta)*   Geological Sciences
BN Mkhwanazi *BSc, BScHons BioChem, MSc MedSc, PhD (UKZN)*   Dietetics & Human Nutrition
F Morris *BSc, MSc Hydrology (UKZN)*   Geography
S Munien *BScHons (UKZN) MSc (UKZN), PhD (UKZN)*   Geography
K Naidoo *BSocSc, BAgricHons, MAgric (UKZN)*   Food Security
SI Ngcobo *BScHons, MSc (UKZN)*   Hydrology
MS Ngidi *BSc, PGDip, MSc Agric, PhD (UKZN)*   Agric. Extension & Rural Resource Management
ND Ngidi *BSocSc, MDev (UKZN)*   Geography
SL Nkomo *BSocSc, BSocScHons, MSc Environmental Management (UKZN*   Geography
N Nongqwenga *BScAgric, MScAgric, PhD (UKZN*   Soil Science
ZT Rani *BScAgric, MSc Agric, PhD (UFH)*   Animal & Poultry Science
SI Stuart-Hill *MSc (Bonn), PhD (UKZN)*   Hydrology
D Trotter Richardson *BScHons, MSc (Natal)*   Geography
NL Wiles *BScDiet, PGDipDiet (Natal), MScDiet, PhD (UKZN)*   Dietetics & Human Nutrition
R Zengeni *BScAgric (Zimbabwe), MPhil (Zimbabwe), PhD (NMMU)*   Soil Science

Developmental Lecturers
N Dladla *BScHons; MSc (UKZN)*   Geological Sciences
S Dube *BSc Agric. (Fort Hare), MScAgric. (Wageningen), PhD (UKZN)*   Agric. Extension & Rural Resource Management
M Gwacela *BSocSc (UKZN), PGDip (UKZN), MAgric (UKZN)*   Agric. Extension & Rural Resource Management
P Leuta-Madondo *BScHons; MSc (UWC)*   Geological Sciences
Z Ncoyini *BScAgric (Fort Hare), MScAgric (Fort Hare)*   Agrometeorology

Senior Tutors
MJC Horan *BScHons (Natal)*   Hydrology

HONORARY APPOINTMENTS

Emeritus Professors
JP Bower *BScAgric MScAgric PhD (Natal)*   Horticultural Science
CM Breen *BSc, MSc (Rhodes), PhD (Natal)*   Geography
RD Diab *MSc, UED (Natal), PhD (Virginia)*   Geography
R Fincham *BAHons, UED (Natal), MA (Western Michigan), PhD (Rhodes)*   Geography
RM Gous *BScAgric, MScAgric, PhD (Natal)*   Animal & Poultry Science
EMW Maunder *PGDipDiet (Leeds MU), BScHons, PhD (London)*   Dietetics & Human Nutrition
S McCourt *BScHons, PhD (Exeter), FGSSA, FGS*   Geological Sciences
E Nel *BScDiet, PGDipDiet (Pretoria)*   Dietetics & Human Nutrition
WL Nieuwoudt *BScAgric (Stell), MScAgric (Pretoria), MEcon (N Carolina), PhD (Natal)*   Agricultural Economics
GF Ortmann *BScAgric, MScAgric, PhD (Natal), Fellow (UKZN)*   Agricultural Economics
FHJ Rijkenberg *BScAgric, MScAgric, PhD (Natal)*   Agric. Extension & Rural Resource Management
MJ Savage *BScHons (Natal), MScAgric(UKZN) , PhD (Natal), DScAgric (UKZN), Fellow (UKZN)*   Agrometeorology
RE Schulze *BScHons, MSc, PhD (Natal), UED (Natal), FRSSAf, PH (USA), Fellow (UKZN)*   Hydrology
MK Watkeys *BScHons (Wales), PhD (Witwatersrand)*   Geological Sciences
AH Wilson *BScHons (London), BSc (Spec Hons), PhD (Rhodesia)*   Geological Sciences

Honorary Professors
JAG Cooper *BSc Hons (Belfast), MSc, PhD Geology (Natal)*   Geological Sciences
C S Everson *BScAgric (Hons), MSc, PhD (Natal)*   Hydrology
JC Hughes *BScHons (Reading), MSc (Queens, Ontario), PhD (Reading)*   Soil Science
P Iji *BScHons IMaiduguri), MSc (Aberdeen), PhD (Adelaide),*   Animal & Poultry Science
SW Kienzle *MSc (Hanover), PhD (Heidelberg)*   Hydrology
GA Kiker *BS, ME. (Florida), PhD (Cornell)*   Hydrology
MC Lyne *BScAgric, MScAgric, PhD (Natal)*   Agricultural Economics
FJ Massawe *BScHons (Sokoine), MSc, PhD (Nottingham)*   Crop Sciences
P Podwojewski *Dr- HDR (Paris VI), MSc, PhD (Strasbourg)*   Hydrology
M Rouget *BSc (Réunion), MSc (UCT), PhD (UCT)*   Geography
P Tongoona *BScHons, MPhil, PhD (Zimbabwe)*   Crop Sciences
M Tsubo *BAgr (Obihiro), MS (Iowa State), PhD (Orange Free State)*   Agrometeorology

Honorary Associate Professors
A Bogale *BSc(AgEco), MSc(AgEco) (Alemaya), PhD (Humboldt)*   Food Security
V Chaplot *Dr-HDR (Paris VI), BSc, MSc, PhD (ENSA)*   Hydrology
J Derera *BScHons, MSc (Zimbabwe), PhD (UKZN)*   Crop Science
JM Green *BScHons (Stellenbosch), MSc (Natal), PhD (Oklahoma State)*   Agric Ext & Rural Resource Mngement
SA Lorentz *BScEng (Witwatersrand), MSc, PhD (Colorado State)*   Hydrology
R Melis *BScAgric (Wageningen), PhD (Natal)*   African Centre for Crop Improvement
A Singels *BScAgric (Stellenbosch), MScAgric, PhD (UFS)*   Crop Science
FJ Veldman *BScHons, MScNut, PhD (North-West), MSEpi (Columbia), MPBL (Aalborg)*   Dietetics & Human Nutrition

Honorary Senior Lecturers
Moodley V *BAHons MA PhD (UDW)*   Geography

Honorary Lecturers
I Basdew *BScHons, MSc, PhD (UKZN)*   Plant Pathology
J Lutchmiah *BA (Unisa), AdvUDip in MPA (UDW), MSocSc (Natal)*   Geography
M Paterson *BScDiet (Pretoria), DiplHospDiet (Stell), MScDiet (Natal), PhD (UKZN)*   Dietetics & Human Nutrition
S Ramburan *BScAgric (UKZN) Crop Science, MScAgric (UKZN) Crop Science, PhD (UFS)*   Plant Breeding
A van Onselen *BScD, MSc (Free State), Nat Dip FSM (Tech Pretoria),PhD (Free State)*   Dietetics & Human Nutrition

Senior Research Associates
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Honorary Research Fellows
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MA Ahmed *BVM Hons (Khartoum), MSc, PhD (UKZN)*   Plant Pathology
HR Beckedahl *BScHons, MSc, HDE (Witwatersrand), PhD (Natal), PrSciNat*   Geography
S Beck-Pay *BScHons, PhD Botany (Natal)*   Plant Pathology
P Chivenge *BScHons, MPhil (Zimbabwe), PhD (UCDavis)*   Soil Science
MM Bopape *BScHons, MSc, PhD Meteorology (UP)*   Hydrology
OJ Botai *BScHons (Moi), MScEng (Sweden), MSc Astrophysics (Rhodes), PhD (UP)*   Hydrology
MA Cho *BScNat.Sc. (Yaounde), MSc)*   Geography
MAM Elbasit *BSc Agric.Eng (UofK), PgDip IT (Nilain), MSc Envi.Eng (Tottori), PhD BioEnviro (Tottori)*   Hydrology
I Germishuizen *MSc (UKZN), PhD (Rome)*   Agricultural Sciences
D Hay *BScHons, MSc (Natal)*   Geography
GPW Jewitt *BScHons, MSc (Natal), PhD (Stellenbosch)*   Hydrology
U Kolanisi *BA (UWC), MSc (NWU-PUK), PhD (NWU)*   Food Security
D Kotze *BScAgricHons, PhD (Natal)*   Geography
RP Kunz *BScHons, MSc (Natal)*   Hydrology
T Mabhaudhi *BScAgric (Zimbabwe), MScAgric, PhD Crop Science (UKZN)*   Crop Science
AD Manson *BScAgric, PhD (Natal)*   Soil Science
M Mengistu *BScAgric (Eritrea), MScAgric (Natal), PhD (UKZN)*   Hydrology
R Meissner *BAHon, MA (RAU), DPhil (UP)*   Hydrology
N Miles *BScAgric, MScAgric, PhD (Natal)*   Soil Science
AA Morris *BSc (Reading) PhD (Reading)*   Agricultural Sciences
LT Nhamo *BScEd (Cuba), AdvDip, PhD (Santiago de Compostela)*   Geography
M Ovechkina *MSc Geology (Moscow), PhD Palaeontology & Stratigraphy (Russia)*   Geological Sciences
K Peerbhay *BSocScHons, MSc, PhD (UKZN)*   Geography
A Ramoelo *BEnvScHons (Venda), MSc (ECIU), PhD (Twente)*   Geography
E Riddell *BScHons (Liverpool), MSc (Wales), PhD (UKZN)*   Hydrology
NA Rivers-Moore *BScHons, MSc (Natal), PhD (UKZN)*   Hydrology
M Salomon *MSc (Radboud), PhD (UKZN)*   Agricultural Extension & Rural Resource Management
C Seethal *BAHons (UDW), MA (Newcastle), BEd (UNISA), MA, PhD Geography (Iowa)*   Geography
GW Shileshi *BSc (Addis), MSc Agriculture (Haramaya), PhD Insect Ecology (Kenyatta)*   Crop Science
B Sivparsad *BSc, BScHons, MSc, PhD (UKZN)*   Plant Pathology
J Taylor *BA (Natal), MSc, PhD (Rhodes)*   Hydrology
T Thambiran *BScHons (Natal); MSc, PhD (UKZN)*   Geography
L Titshall *BScHons, MSc (Natal), PhD (UKZN)*   Soil Science
ML Toucher *BScHons (Natal), MSc, PhD (UKZN)*   Hydrology
E van Zyl *BScAgric, BScAgric Hons (UFS), PhD (Limpopo), MSc Vet Science (UP)*   Plant Pathology
K Vincent *BScHons (Oxford); MRes, PhD EnvSc (East Anglia)*   Geography
H Watson *MSc (Natal), PhD (UDW)*   Geography
A Wood *BScHons, MSc (Natal), PhD (Stellenbosch)*   Plant Pathology
M Zhou *BSc Agric (UZ), MSc Agric (Natal), MS Applied Stats (LSU), PhD (LSU)*   Plant Breeding

School of Chemistry and Physics
Dean and Head of School
Professor RS Robinson

Senior Professors
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Professors
F Albericio *BSc, MSc, PhD (University of Barcelona)* Chemistry
P Ajibade *BScHons, MSc (Ibadan), PhD (UniZul)* Chemistry
HB Friedrich *BScHons, PhD (UCT)* Chemistry
NA Koorbanally *BScHons, MSc, PhD (Natal)* Chemistry
BS Martincigh *BScHons, PhD (Natal), MASSAf, FSACI* Chemistry
V Nyamori *BSc (Egerton), BScHons, MSc (UPE), PhD (NMMU), FRSC* Chemistry
F Petruccione *Dipl. Phys., Dr rer nat, Dr rer nat habil (Freiburg)* Physics
FR van Heerden *BScHons, MSc, PhD (Orange Free State), FRSSAf* Chemistry
WE van Zyl *BScHons, MSc (RAU), PhD (Texas A & M)* Chemistry
S Venkataraman *BSc, MSc (Bharathidasan), PhD (Sri Venkateswara)* Physics

Associate Professors
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MD Bala *BScHons (ABU), MSc (ATBU), PhD (ECUST)* Chemistry
N Chetty *BScHons (Natal), PhD (UKZN)* Physics
IN Booysen *BScHons, MSc, PhD (NMMU)* Chemistry
T Konrad *Dipl. Phys (Tübingen), MSc (Imperial College), Dr rat nat (Konstanz)* Physics
Yin-Zhe Ma *BScHons (Nanjink University), MSc (Chinese Academy of Sciences), PhD (Cantab)* Physics
GT Mola *BSc, MSc (Addis Ababa), PhD (Bonn)* Physics
B Moodley *BScHons, MSc (Natal), PhD (UKZN)* Chemistry
SO Ojwach *BScHons (Nairobi), MSc (Western Cape), PhD (Johannesburg)* Chemistry
BO Owaga *BSc (Egerton), BScHons, MSc, PhD (Witwatersrand)* Chemistry
RS Robinson *BScHons, PhD (Rhodes)* Chemistry
S Singh *BScHons, MSc (UDW), PhD (UKZN)* Chemistry

Senior Lecturers
VW Couling *BScHons, MSc, PhD (Natal)* Physics
V Jeena *BScHons, MSc, PhD (UKZN)* Chemistry
AS Mahomed *BSc (UDW), BScHons (UDW), MSc (UDW), PhD (UKZN)* Chemistry
A Mambanda *BScHons, MSc (Zimbabwe), PhD (UKZN)* Chemistry
M Mariola *BSc Eng, MEng (La Sapienza), PhD (UKZN)* Physics
AP Matthews *BScHons (Natal), PhD (Cantab)* Physics
MK Moodley *MSc (UDW), PhD (Witwatersrand)* Physics
R Moodley *BScHons (UDW), MSc, PhD (UKZN)* Chemistry
T Moyo *BSc (UNZA), PhD (Leeds)* Physics
OS Olatunji *BScHons, (Jos), MSc, PhD (Ib.)* Chemistry
V Paideya *BSc, HDE (UDW), MEd (UKZN), PhD (UKZN)* Chemistry
K Pruessner *Dipl.-Min. (Göttingen), Dr. rer. nat. (Stuttgart)* Chemistry
I Sinayskiy *Dipl. Phys, Kandidat Nauk (Samara)* Physics
P Singh *BScMed, MSc (GNDU), PhD (GNDU)* Chemistry
T Singh *BTech (MLST), MTech (DIT), PhD (UKZN)* Chemistry
M Tukulula *BScHons, MSc (Rhodes), PhD (UCT)* Chemistry
AM Ukpong *BScHons (Calabar), MTech (Akure), PhD (UCT)* Physics

CGL Veale *BPharm (Rhodes), MSc (Edin), PhD (Rhodes)*   Chemistry

Lecturers
A Bissessur *BScHons, MSc (UDW)*   Chemistry
NB Dlamini *BSc, BScHons, MSc, PhD (UKZN)*   Physics
H Govender *BSc (Unisa), BScHons (UDW), MSc, PhD (UKZN)*   Chemistry
BP Gumbi *BSc, BScHons, MSc, PhD (UKZN)*   Chemistry
Y Ismail *BScHons, MSc, PhD (UKZN)*   Physics
P Khoza *BSc (UKZN), BScHons (UZ), MSc (UJ), PhD (Rhodes)*   Chemistry
GEM Maguire *BScHons (NUI), PhD (Belfast)*   Chemistry
CJ Masina *BSc, BScHons (UniZulu), PhD (NMMU)*   Physics
PN Mahlambi *ND (DUT), BTECH (DUT), MTech (DUT), PhD (Witwatersrand)*   Chemistry
TD Malevu *BScHons, MSc, PhD (UFS)*   Physics
M Moodley *MSc (Natal), MS, PhD (Rhode Island)*   Physics
S Moolla *BScHons, MSc (UDW), PhD (UKZN)*   Physics
SH Mthembu *BScHons, MSc, PhD (UKZN)*   Physics
Z Mtumela *BScHons (WSU), MSc, PhD (UKZN)*   Physics
D Reddy *BScHons, PhD (UKZN)*   Chemistry
ML Shozi *BScHons, MSc, PhD (UKZN), Cert Bus Management (UNISA)*   Chemistry
S Sithebe *BScHons, PhD (UKZN)*   Chemistry
B A Xulu *BScHons, MSc (Natal), PhD (Oklahoma)*   Chemistry

nGAP Lecturers
WB Dlamini *BScHons, MSc (UKZN), PhD (UKZN)*   Physics
FT Nevondo *BSc, BScHons, MSc (UKZN)*   Chemistry
TS Papo *BScHons, MSc (UKZN)*   Chemistry

Senior Tutors
K L Barry *BScHons, MSc (UPE)*   Chemistry
GD Dawson *BScHons, MSc (UPE)*   Chemistry
MH Hlongwane *BSc Computational Physics, BScHons, MSc (UKZN)*   Physics
C Koorbanally *BSc (Hons), MSc, PhD (Natal)*   Chemistry
N Majola *BSc Computational Physics, BScHons, MSc (UKZN)*   Physics
BP Mshengu *BScHons, MSc, PhD (UKZN)*   Chemistry
SS Ntombela *BScHons, MSc (UKZN)*   Physics
UM Pillay *BSc, BScHons (UDW), MSc (UKZN)*   Physics
M Rasalanavho *BSc Hons (UNIVEN), HED (Unisa), Dip Bus Management (Damelin), MSc (UKZN)* Chemistry
E Zhandire *BScHons (NUST), MSc (Reading)*   Physics

HONORARY APPOINTMENTS
Emeritus Professors
K Bharuth-Ram *BScHons, MSc (Natal), DPhil (Oxon), MASSAf*   Physics
OL de Lange *BScHons, MSc (Witwatersrand), PhD (Clarkson)*   Physics
TB Doyle *BScHons (Dunelm), PhD (Witwatersrand)*   Physics
SE Drewes *BScHons, MSc (Natal), PhD (Rhodes), DSc (Natal), CChem, FRSC, FRSSAf, FSACI*   Chemistry
TA Ford *BScHons, MSc (Wales), PhD (Dalhousie), CChem, FRSC, FSACI, MASSAf*   Chemistry
MA Hellberg *BScHons (UCT), PhD (Cantab), FRSSAf, MASSAf*   Physics
JD Hey *BSc (Stellenbosch), BScHons, MSc (UCT), PhD (Maryland)*   Physics
ARW Hughes *BA, MSc (Dublin), PhD (Sheffield), FRAS*   Physics
TM Letcher *BScHons, BEd, MSc, PhD (Natal), CChem, FRSC, FRSSAf, FSACI*   Chemistry
RE Raab *BScHons (Natal), DPhil (Oxon)*   Physics

Honorary Professors
N Crouch *BScHons, MSc, PhD (Natal)*   Chemistry
ML Davies *MChem (Swansea), PhD Swansea and Universidade de Coimbra*   Chemistry
P Douglas *BScHons (Newcastle), PhD (University College, London), CSci, CChem, FRSC, ASIS, FRPS*Chemistry
A Ekert *BScHons, MSc (Jagiellonian), DPhil (Oxon)*   Physics
D Mulholland *BScHons, MSc, PhD (Natal)*   Chemistry
JKK Rhee *BE (SNU), MSc (SNU), PhD (UMichigan)*   Physics
J Sievers *BSc (MIT), PhD (Caltech)*   Physics
F Verheest *MSc, PhD, DSc (Gent)*   Physics

Honorary Associate Professors
A Kindness *BScHons, MSc, PhD (Aberdeen)*   Chemistry
S Nic Chormaic *BScHons, MSc (Nat. Univ. Ireland, Maynooth), PhD (Paris VIII)*   Physics
G Pellicane *BScHons, PhD (Messina)*   Physics

Honorary Lecturers
J Pierrus *BScHons (Natal), MSc (Witwatersrand), PhD (Natal)*   Physics

Senior Research Associates
K Bharuth-Ram *BScHons, MSc (Natal), DPhil (Oxon), MASSAf*   Physics
TA Ford *BScHons, MSc (Wales), PhD (Dalhousie), CChem, FRSC*   Chemistry
JD Hey *BSc (Stellenbosch), BScHons, MSc (UCT), PhD (Maryland)*   Physics
MA Hellberg *BScHons (UCT), PhD (Cantab), FRSSAf, MASSAf*   Physics
TM Letcher *BScHons, BEd, MSc, PhD (Natal), CChem, FRSC, FRSSAf, FSACI*   Chemistry

Honorary Research Fellows
H Bencherif *BSc (Univ. Hassan2), MSc (Univ. d'Orléans), PhD (Universite Paris 6)*   Physics
F Giraldi *MSc (UNIPI), PhD (UNT)*   Physics
D Li *BScHons, MSc (PKU), PhD (Cornell)*   Physics
S Maddila *BSc (Andhura), MSc, PhD (Sri Venkateswara)*   Physics
P Ndungu *BSc (Tennessee), PhD (Drexel)*   Chemistry

School of Engineering
Dean and Head of School
Professor G Bright

Professors
S Adali *BScEng (METechU), PhD (Cornell), FRSSAf, Fellow of UKZN*   Mechanical Engineering
JT Agee *B Eng (ATBU), M Eng (ATBU), PhD (ATBU)*   Electrical Engineering
TJO Afullo *PrEng, BScEng (Nairobi), MSEE (W. Virginia), PhD (Brussels)*   Electronic Engineering
G Bright *PrEng, BScEng, MScEng, PhD (Natal), MBA (UKZN)*   Mechanical Engineering
CA Buckley *PrEng, BScEng, MScEng (Natal)*   Chemical Engineering
DG Dorrel *BEng (Hons) (Leeds), MScEng (Bradford), PhD (Cantab), CEng, FiET (UK)*   Electrical Engineering
I Govender *BSc (UDW), HDE (UNISA), Hons (UCT), PhD (UCT)*   Chemical Engineering
P Naidoo BScEng, PhD (Natal)   Chemical Engineering
D Ramjugernath *BScEng, PhD (Natal)*   Chemical Engineering
JC Smithers *PrEng, BScEng, MScEng, PhD (Natal)*   Bioresources Engineering
C Trois *PrEng (Italy), MSc(Eng), PhD (Cagliari),*   Civil Engineering
A Stark *Dipl.-Chem (FH), PhD (Belfast)*   Chemical Engineering
J-R Tapamo *BSc, MSc (Yaoundé), DEA, PhD (Rouen)*   Computer Engineering
TS Workneh BScEng (HU, Ethiopia), MScEng (UCD, Ireland), PhD (Free State)   Bioresources Engineering

H Xu *BSc (Guilin), MSc (Shijiazhuang), PhD (Beijing)*   Electronic Engineering

Associate Professors
J Ben-Edigbe *BEng (Hons), MSc (Salford), PhD (Strathclyde)*   Civil Engineering
MJ Brooks *PrEng, BScEng (Natal), MScEng, PhD (Stellenbosch)*   Mechanical Engineering
DK Das *BSc (Utkal) BSc.Eng (Sambalpur) M.C.P(IIT KGP) PhD(IIT Roorkee)*   Civil Engineering
G Drosopoulos *PrEng (Greece), Dip Eng (NTUA), PhD Eng (UOI)*   Civil Engineering
FL Inambao *MSc, PhD (Volgograd)*   Mechanical Engineering
M Kumarasamy *BE, ME, PhD (IIT Roorkee)*   Civil Engineering
D Lokhat *BScEng, MScEng, PhD (UKZN)*   Chemical Engineering
AH Mohammadi *BScEng, MScEng (Tehran), MPhil, PhD (Heriot-Watt)*   Chemical Engineering
MMH Mostafa *PrEng, BSc, MSc (Suez Canal Uni), PhD (Liverpool)*   Civil Engineering
R Rawatlal *BScEng, MScEng, PhD (UKZN)*   Chemical Engineering
AK Saha BEE (India), PhD (India)   Electrical Engineering
GDJ Smith *PrEng, BScEng, MScEng (Natal), PhD (Cantab)*   Mechanical Engineering
VM Srivastava *BTech, MTech, PhD (India)*   Electronic Engineering
R Stopforth *PrEng, BScEng, MScEng (UKZN)*   Mechanical Engineering
T Walingo *B Tech Elec Eng (Moi), MScEng (Natal), PhD (UKZN)*   Electronic Engineering

Senior Lecturers
AA Aburas *BSc (Tripoli), MSc (Dundee), PhD (DeMontFort)*   Computer Engineering
M Akombelwa *BEng (Zambia), MSc, PhD (Nottingham*)   Land Surveying
AM Forbes *BScSur, MScSur (Natal)*   Land Surveying
N Harinarain PropDevHons(QS), MSc(QS) (Natal), PhD (UKZN)   Construction Studies
ALL Jarvis *BScEng (Natal), PhD (UKZN)*   Electronic Engineering
MW Kiliswa *PEng, BTech, MScEng, PhD (UCT)*   Civil Engineering
P Kumar *PrEng, BTech, MEng, PhD (India)*   Electronic Engineering
GL Lagerwall *BScEng (UKZN), MScEng, PhD (Florida)*   Bioresources Engineering
CH McLeod *BScEng (Natal), MScEng, (Stellenbosch), PhD (Stellenbosch)*   Civil Engineering
K Moodley BScEng, MScEng, PhD (UKZN)   Chemical Engineering
B Naidoo *BScEng, MScEng (Natal)*   Computer Engineering
WM Nelson *BScEng, MScEng, PhD (UKZN)*   Chemical Engineering
J Padayachee *BScEng, MScEng (UKZN) PhD (UKZN), MSAIMechE*   Mechanical Engineering
N Pillay *BScEng,* MScEng (Natal), PhD (UKZN)   Electronic Engineering
J Pitot *BScEng, MScEng (UKZN), PhD (Stellenbosch)*   Mechanical Engineering
J Pocock *BEng (Hons), MPhil (Eng), PhD (Birmingham)*   Chemical Engineering
T Quazi *BScEng, MScEng (Natal), PhD (UKZN)*   Computer Engineering
A Senzanje BScHons, MSc (Cranfield), PhD (Colorado State)   Bioresources Engineering
A Swanson *BScEng, MScEng, PhD (Witwatersrand)*   Electrical Engineering
R Tiako *BScHons (Akure), MScEng (UCT), PhD (Curtin)*   Electrical Engineering

Lecturers
JT Adu *B Eng (BUK), MSc (UNILAG), MSc (UNILAG), PhD (UKZN)*   Civil Engineering
F Aneke *BSc (ESUT) MEng (UJ) DEng (CUT)*   Civil Engineering
A Athol-Webb *BScEng (UKZN), MScEng (UKZN)*   Mechanical Engineering
CI Basson *BScEng (NWU), MScEng (UKZN*)   Mechanical Engineering
C Bemont *PrEng, BScEng (Natal), PhD (UKZN)*   Mechanical Engineering
E Bhero *PrEng, B.Eng, MPhilEng (NUST), LLB (UKZN), PhD (NWU)*   Computer Engineering
N Brijmohan *BScEng (UKZN), MScEng (UKZN*)   Chemical Engineering
M Brown *BScEng, MScEng (UKZN)*   Electrical Engineering
JET Collins*, BScEng (Natal), MScEng(UKZN)*   Mechanical Engineering
SM Chilufya *BEng (UNZA), MSc (ITC)*   Land Surveying
E Friedrich *BScHons, MScEng (Natal), PhD (UKZN)*   Civil Engineering

F Ghayoor *BSc, MSc (Isfahan University of Technology), PhD (UKZN)* — Electronic Engineering
A Kassim, *BScEng, MScEng, PhD (UKZN)* — Bioresources Engineering
RL Khuboni *BScEng, MScEng (UKZN)* — Computer Engineering
NO Matete *BScEng, PhD (UKZN)* — Civil Engineering
NM Mkhize *BScEng, MScEng (UKZN), PhD (Stellenbosch)* — Chemical Engineering
S Moodley *BScEng, MScEng, PhD (UKZN)* — Chemical Engineering
S Mpembe *PrEng, BScEng (UKZN) MScEng (Kyoto)* — Civil Engineering
E Musonda *BEng, (UNZA), MSc (ITC)* — Land Surveying
MG Ntunka *BScEng, GDE (UNILU)*, *MScEng (Witwatersrand)* — Chemical Engineering
EM Obwaka *HDip (Strathmore), BScEng, MScEng (UDW)* — Chemical Engineering
B Olalusi *BEng (FUTA), MSc (FUTA), PhD (Stellenbosch)* — Civil Engineering
K Osman *BScEng, MSc.Eng, PhD (UKZN)* — Chemical Engineering
J Parker *BScEng, MScEng (UKZN)* — Computer Engineering
R Pillay Carpanen *BEng (Hons) (Mauritius), MScEng, PhD (UKZN)* — Electrical Engineering
JJ Pringle *BScEng, MSc, PhD (UKZN)* — Civil Engineering
S Rezenom *BSc (Eng) (Hons) (UZ), MScEng (UKZN)* — Electronic Engineering
A Singh *PrEng, BScEng, MScEng (UDW)* — Chemical Engineering
M Singh *PrSciNat, BSc, BScHons (UKZN), MSc (Witwatersrand) PhD (UKZN)* — Land Surveying
T Velthyusen, *BScEng (UKZN), MScEng(UKZN* — Mechanical Engineering

Developmental Lecturers
KA Johnson *BScEng, MScEng (UKZN)* — Civil Engineering
N Maseko-Owolawi *BSc (UKZN), BSc Hons (UniZulu), MSc Eng (NC State)* — Chemical Engineering
K Mugodo *BScEng (UKZN), MScEng (UKZN)* — Bioresources Engineering
SL Shange *BScEng (UKZN) MScEng (Leeds*) — Civil Engineering

Senior Tutors
M Hansen *Pr Eng, BSc Eng* — Bioresources Engineering

HONORARY APPOINTMENTS

Emeritus Professors
S Adali *BScEng (METechU), PhD (Cornell)* — Mechanical Engineering
M Carsky *PrEng, Dipl-Ing,PhD (Prague)* — Chemical Engineering
E Eitelberg *PrEng,Dipl-Ing,Dr-Ing,Dr-Ing.habil(Karlsruhe),LL.M.(UDW),LL.D(UKZN)* — Electrical Engineering
BK Loveday *PrEng, BScEng, PhD (Natal)* — Chemical Engineering
PW Lyne *PrEng, BScEng, MScEng, PhD (Natal)* — Bioresources Engineering
M Mulholland *PrEng, BScEng, PhD (Natal)* — Chemical Engineering
RG Pearl *Dip(QS), MScQS (UCT)* — Civil Engineering
GGS Pegram *PrEng, BScEng, MScEng (Natal), PhD (Lancaster)* — Civil Engineering
JD Raal *BScEng (Witwatersrand), MSc, PhD (Toronto)* — Chemical Engineering
LW Roberts *PrEng, BScEng, MScEng (Natal), PhD (London)* — Mechanical Engineering
DD Stretch *BScEng, MScEng (Natal),PhD(Cantab)* — Civil Engineering

Honorary Professors
LG Agata, *MSc, PhD (Catania*) — Civil Engineering
A Bardossy *BScHons, PhD (Budapest, DrIng, Drhabil (Karlsruhe)* — Civil Engineering
U Domanska *Bs, Ms, PhD, DrHab (Warsaw)* — Chemical Engineering
D Enke *Dip(Halle), PhD(Halle)* — Chemical Engineering
GL Foutch, *BScEng, MScEng, PhD (Missouri-Rolla)* — Chemical Engineering
L Fulcheri *BScEng (Paristech), MScEng, PhD, HDR (INP-Grenoble)* — Chemical Engineering
S Govender *BScEng, MScEng, PhD (UDW), DEng (Pretoria)* — Mechanical Engineering
AC Hansen *PrEng, BScEng, MScEng, PhD (Natal)* — Bioresources Engineering
NM Ijumba *PrEng, BSc (Hons)Eng (Dar-es-Salaam), MSc (Salford), PhD (Stratchclyde)* — Electrical Engineering

S Krischok *Dip(Clausthal), PhD (Clausthal)*   Chemical Engineering
JS Levine *PhD (Paris-Dauphine)*   Electrical Engineering
BC Meikap *BSc(Hons), BTech (Calcutta), MTech, PhD (IIT, Kharagphur)* Chemical Engineering
AV Mudring *DipChem (RFW), PhD (RFW)*   Chemical Engineering
L Negadi *BSc, MSc, PhD (Tlemcen)*   Chemical Engineering
S Pereda *BEng, PhD (Nacional del Sur)*   Chemical Engineering
R Rogers *BScHons (Alabama), PhD (Alabama)*   Chemical Engineering
BB Sithole *BScEng (Sierra Leone), MScEng(Aberdeen), PhD (Dalhousie)* Chemical Engineering
GK Venayagamoorthy *BEng (Abubakar Tafawa Balewa), MScEng, PhD (UKZN)* Electrical Engineering
SK Venayagamoorthy *BScEng, MScEng (UKZN), PhD (Stanford)*   Civil Engineering
RA Venditti *BSc (North Carolina), PhD (Princeton)*   Chemical Engineering

Honorary Associate Professors
M Coni, *MSc, PhD (Pisa)*   Civil Engineering
AJ Cotel, *MSc, PhD (Washington)*   Civil Engineering
PR Everitt *BScEng, MScEng(Natal)*   Civil Engineering
NL Lecler *BScEng, MScEng, PhD (UKZN)*   Bioresources Engineering
KO Papailiou MSc (Braunschweig), MSc (Stuttgart), PhD (ETH)   Electrical Engineering

Honorary Senior Lecturers
HW Bernhardt *PrEng, PhD (Natal), BEd*   Chemical Engineering

Senior Research Associates
CJ Brouckaert *BScEng (Natal)*   Chemical Engineering

Honorary Research Fellows
A N Hasan *BEng (Hashemite), MEng (NWU)*   Mechanical Engineering
B Brouckaert *BScEng (Natal), MS, PhD (Georgia Tech)*   Chemical Engineering
F Coulon *MSc (Western Brittany), PhD (Perpignan)*   Civil Engineering
K Eales *BAHons (UN), MA (Wits),MBA (UP)*   Chemical Engineering
B Genevieve *BScEng (UKZN), MScEng (UKZN)*   Mechanical Engineering
I Kerr *BSc (Ind Chem) (Witwatersrand), MDP (UNISA), MSc(Env Biotech) (Rhodes)* Chemical Engineering
M Królikowska *MA, PhD (Warsaw)*   Chemical Engineering
M Królikowski *MA, PhD (Warsaw)*   Chemical Engineering
I Kucuk *BSc (Istanbul), MSc (Ohio State), PhD (Utah)*   Mechanical Engineering
M Lasich *BScEng, MScEng, PhD (UKZN)*   Chemical Engineering
NA Macleod *PrEng, BScEng, MBA (UKZN)*   Chemical Engineering
L Maharaj, *BScEng, MScEng, PhD (UKZN)*   Chemical Engineering
C Narasigadu *BScEng, MSc, PhD (UKZN)*   Chemical Engineering
TMN Ngatched *BScHons, MSc (Cameroon), MScEng (Natal), PhD (UKZN)*   Electronic Engineering
AS Oktem *BScEng, MScEng (YTU), PhD (Utah)*   Mechanical Engineering
AAE Othman *BSc (Arch Eng), MSc (Heriot-Watt), PhD (Loughborough)*   Civil Engineering
L. Oxarango *MScEng, PhD (Toulouse)*   Civil Engineering
G Rattan *BE (Panjab), ME (Panjab), PhD(Panjab)*   Chemical Engineering
M Şimşek, *BScEng (ITU), MScEng, PhD (YTU)*   Mechanical Engineering
S Sinclair *BScEng, MScEng (Natal), PhD (UKZN)*   Civil Engineering
RG Stephen *BScEng, MBA (Wits), MSc (Natal), PhD (UCT)*   Electrical Engineering
E Tilley *MASc (British Columbia), PhD (ETH Zürich)*   Civil Engineering
V Tramontin *PrEng, MEng, PhD (Cagliari), (Italy)*   Construction Studies
R Yin *BScEng (Yanbian), MSc (UKZN), PhD (Zhejiang)*   Electronic Engineering

Adjunct Appointments

Professors
T C Haupt *MPhil (Leicester), Pr. CM, PhD (Florida)* — Construction Studies
D Kalumba *BScEng (Makerere), MScEng (UCT), PhD (Newcastle)* — Civil Engineering

Associate Professors
L Combrinck *BSc, BScHons (Unisa), MSc, PhD (UCT), Dip.Dat, PBL. Cert (Unisa)* — Land Surveying

Senior Lecturer
D Scussel *BScEng, MScEng (Caglian), PhD (UKZN)* — Civil Engineering

Lecturer
J Govender, *BScEng (UKZN), MEng(UP)* — Mechanical Engineering
R Loubser *PrEng, BScEng, MScEng, PhD (Natal)* — Mechanical Engineering

School of Life Sciences
Dean and Head of School
Professor AO Olaniran

Professors
RP Beckett *BScHons (St Andrews), PhD (Bristol)* — Biology
THT Coetzer *BScHons, MSc (Stellenbosch), PhD (Natal)* — Biochemistry
CT Downs *BScHons, PhD, MEd (Natal)* — Biology
AS Gupthar *BScHons (UDW), MSc, PhD (Witwatersrand), PhD (UKZN)* — Biochemistry
SD Johnson *BScHons, PhD (UCT)* — Biology
EB Guegium Kana *MSc, PhD (Ogbomosa)* — Microbiology
MS Islam *BScHons, MSc (Dhaka), PhD (Okayama, Japan)* — Biochemistry
KP Kirkman *BScAgric, MScAgric, PhD (Natal)* — Biology
AO Olaniran *BScHons, MSc (OAU), PhD (UKZN)* — Microbiology
S Schmidt *Dipl. Biol., Dr rer nat habil (Hamburg)* — Microbiology
R Slotow *BScHons (Rhodes), MSc (Natal), PhD (California)* — Biology
MP Watt *BScHons, PhD (Witwatersrand)* — Biology

Associate Professors
JF Finnie *BScHons, PhD (Natal), MEd (UKZN)* — Biology
JPD Goldring *BSc (Dundee), DPhil (Zimbabwe)* — Biochemistry
J Lin *BSc (National Tsing Hua University), PhD (SUNY at Buffalo)* — Microbiology
Y Naidoo *BScHons, MSc, PhD (UDW)* — Biology
CU Niesler *BScHons (Stellenbosch), PhD (Cantab)* — Biochemistry
UM Scharler *BSc (Salzburg), BScHons, PhD (UPE)* — Biology
P Scogings *BSc (Natal) MSc (Pretoria) PhD (Fort Hare)* — Biology
M Singh *BScHons, MSc (UDW), PhD (UKZN)* — Biochemistry
A Vosloo *BScHons, PhD (PU for CHE)* — Biology

Senior Lecturers
MA Adeleke *B. Agric Hons, M.Agric, PhD (UNAAB)* — Genetics
A Bastian *BSc, MSc (LUH, Germany), PhD (TiHo, Germany)* — Biology
B Bytebier *MSc (Brussels), PhD (Stellenbosch)* — Biology
N Carrasco *BScHons, PhD (UKZN)* — Biology
HY Chenia *BScHons, MSc, PhD (UDW)* — Microbiology
M Ghai *BSc (Panjab University), MSc. PhD. (Punjab Agricultural University)* — Genetics
D Glassom *BSc (Witwatersrand), BScHons (UPE), MSc (UCT), PhD (Bar Ilan)* — Biology

P Govender *BScHons, MSc (UDW), PhD (Stellenbosch)*	Biochemistry
R Govinden *BSc (UDW), Licence (Caen), Maitrise (Marseilles), MSc, PhD (UKZN)*	Microbiology
R Hewer *BScHons, MSc (RAU) PhD (UJ)*	Biochemistry
AHH Macdonald *BA (Hawaii), PhD (UKZN)*	Biology
M Okpeku *B.Agric (Ambrose Alli, Ekpoma), MSc (UNIBEN), PhD (FUNAAB)*	Genetics
T Olckers *BScHons, PhD*	Biology
C Pillay *BScHons, MSc, PhD (Natal)*	Genetics
S Ramdhani *BScHons, MSc (UDW), PhD (Rhodes)*	Biology
S Shaik *BPaed(Sc), BScHons, MSc (UDW), PhD (UKZN)*	Biology
Z Tsvuura *BScHons, MSc (Zimbabwe) PhD (UKZN)*	Biology
T van der Niet *MSc (WUR), PhD (UZH)*	Biology
D Vosloo *BSc, MSc (PU for CHE), PhD (North-West)*	Biology
S Willows-Munro *MSc, PhD (Stellenbosch)*	Genetics
OT Zishiri *BScHons, MSc, PhD (Stellenbosch)*	Genetics

Lecturers

S Chamane *BScHons, MSc, PhD (UKZN)*	Biology
TE Chiliza *BScHons (UKZN), MSc (Pretoria), PhD (UKZN)*	Microbiology
E Dzomba *BScAgric, MScAnimSci (Zimbabwe)*	Genetics
PP Gumbi *BScHons, MSc (UKZN), PhD (UCT)*	Biochemistry
S Jamal-Ally *MSc, PhD (Witwatersrand)*	Microbiology
T N Khoza, *BscHons (UCT), MSc, PhD (WITS)*	Biochemistry
J Lebepe *BSc (Univen), BScHons, MSc, PhD (UL)*	Biology
A Magadlela *BSc, BScHons (WSU), MSc, PhD (SU)*	Biology
MS Meusel *MSc, PhD (Frankfurt/Main)*	Biology
BG Makhubo *BScHons (UFS), MSc (SUN)*	Biology
GK Moodley *BScHons, MSc (UDW)*	Biology
T Miya *BScHons, MSc (UFS), PhD (RU)*	Biology
TC Munyai *BEHERM, MENVSc (UniVen)*	Biology
NE Mvubu *BScHons, PhD (UKZN)*	Biology
K Pillay *BScHons, MSc, PhD (UKZN)*	Biochemistry
OJ Pooe *BScHons, MSc, PhD (UKZN)*	Biology
M Tedder *BScHons, MSc, PhD (UKZN)*	Biology
SI Tshilwane *BScHons (UL), MSc (UP), PhD (UP)*	Biology
M Kraai *BScHons (WSU), MSc (NMMU)*	Biology

Developmental Lecturers

RS Mokhosi *BscHons, MSc (UKZN)*	Biochemistry

Senior Tutors

PA Joslin *BScHons (Wales), PhD (Lancaster)*	Biology
HFP Payne, *BSc(Hons)(Zimbabwe), MSc (UKZN)*	Biology
P Seaman *BScHons (Rhodes), MSc (UKZN)*	Biology
A Shuttleworth *BScHons, PhD (UKZN)*	Biology

HONORARY APPOINTMENTS

Emeritus Professors

CC Appleton *BScHons (PU for CHE), MSc (Rhodes), PhD (Murdoch)*	Biology
M Ariatti *BScHons (London), DPhil (Rhodesia)*	Biochemistry
R Biseswar *BScHons (Unisa), MSc (UDW), PhD (UCT), HED (Unisa)*	Biology
DJ Brothers *BScHons (Rhodes), PhD (Kansas)*	Biology
JA Cooke *BScHons, PhD (Newcastle), CertEd(Tech) (Birmingham)*	Biology
C Dennison *BScAgric, MScAgric, PhD (Natal)*	Biochemistry

RC Hart *BScHons (Natal), PhD (Rhodes), DSc (Natal)*	Biology
B Lovegrove *BScHons, PhD (UCT)*	Biology
S Mukaratirwa *DVM (Bayamo), MVSc (Liverpool), PhD (Copenhagen)*	Biology
G Naidoo *BScHons, UED (Unisa), MSc (UDW), PhD (Tennessee), PrSciNat*	Biology
N Pammenter *MSc (Natal), PhD (Leeds), MASSAf*	Biology
R Perissinotto *Laurea Biol Sciences (Padua), PhD (Dalhousie)*	Biology
MR Perrin *BScHons (London), PhD (Exeter), FRSSAf*	Biology
B Pillay *BScHons, MSc (UDW), Dr rer nat (Wuerzburg)*	Microbiology
NM Tainton *BSc Agric, MScAgric (Natal), PhD (Wales)*	Biology
A Thandar *BScHons, MSc (Unisa), PhD (UDW), PrSciNat*	Biology
J van Staden *BScHons, MSc (Stellenbosch), PhD (Natal), FRSSAf*	Biology
FM Wallis *BScAgric, MScAgric, PhD (Natal)*	Microbiology

Honorary Professors

GC Bate *BScAgric (Natal), MSc, PhD (Ontario)*	Biology
CA Chapman *BScHons, MSc, PhD (Alberta)*	Biology
P Goldblatt *BScHons (Witwatersrand), PhD (UCT)*	Biology
JC Groeneveld *BSc (Stellenbosch), BScHons, MSc (Port Elizabeth), PhD (UCT)*	Biology
DG Herbert *BScHons, PhD (London)*	Biology
A Latif *BVSc, MVSc (Khartoum), PhD (ICIPE/Khartoum)*	Biology
MJ Lawes *BScHons, MSc, PhD (Natal)*	Biology
JC Manning *BScHons, PhD (Natal)*	Biology
VL Őrdög *MSc, PhD (University of Agricultural Sciences, Gödöllö)*	Biology
C Packer *BA (Stanford), PhD (Sussex)*	Biology
D Roberts *BScHons, PhD (Natal)*	Biology
MH Schleyer *BScHons (Witwatersrand), MSc, PhD (Natal)*	Biology
D Ward *BScHons, PhD (Natal)*	Biology

Honorary Associate Professors

ST Fennessy *BSc (Natal), BScHons (UDW), PhD (Natal)*	Biology
ML Hamer *BScHons, MSc, PhD (Natal)*	Biology
R Maharaj *BScHons, MSc, PhD (Natal)*	Biology
T Mwabvu *BScHons, MSc (Zimbabwe), PhD (Rhodes)*	Biology
MC Schoeman *BScHons, PhD (UCT)*	Biology
AM Shrader *BScHons, MSc (Natal), PhD (Witwatersrand)*	Biology
S Woodborne *BA Hons, PhD (UCT)*	Biology

Honorary Senior Lecturers

RJ Brinkerhoff *BS (Illinois), MS (North Carolina State), PhD (Colorado)*	Biology
DE Conlong *BScHons, MSc, PhD (Natal)*	Biology
C Morris *BScAgric, MScAgric, BBiblHons (Natal)*	Biology
S Rutherford *BScHons (Reading), MBA (Cardiff), PhD (Natal)*	Biology
S Ryan *BA (Princeton), PhD (Berkeley)*	Biology
SJ Snyman *BScHons (Witwatersrand), MSc (Natal), PhD (Stellenbosch)*	Biology

Honorary Lecturers

D Druce *BScHons, MSc (Natal), PhD (UKZN)*	Biology
CF Mackay *BScHons, MSc (Zululand), PhD (Rhodes)*	Biology
BQ Mann *BSc (Natal), BScHons, MSc (Rhodes)*	Biology

Senior Research Associate

T Anderson *BScAgric, MScAgric, PhD (Natal)*	Biochemistry
H Baijnath *BScHons (UNISA), MSc (UDW), PhD (Reading), FLS*	Biology
E Elliott *BScHons, MSc, PhD (Natal)*	Biochemistry

T Everson *BScHons, MSc, PhD (Natal)*   Biology
B Masola *BScHons (Nottingham Trent), PhD (London)*   Biochemistry
B Page *BScHons, MSc (WITS)*   Biology
RD Stone *BA (California, Santa Cruz), MLA, PhD (California, Berkley)*   Biology

Honorary Research Fellows
H Adie *BScHons, MSc, PhD (Natal)*   Biology
O Aremu *BSc(Hons) (Obafemi Awolowo), MSc, PhD (UKZN)*   Biology
E Balázs *MSc (Univ. Horticulture, Budapest), DSc (Hungarian Acad. Sci.), PhD (Eötvös Loránd, Budapest) doctorat d'etat (Louis Pasteur, Strasbourg).*   Biology
D Barraclough *BScHons, MSc (Natal), PhD (UNSW)*   Biology
R Boon *MSc (Natal)*   Biology
A Bownes *BSc Hons, MSc, PhD (Rhodes)*   Biology
K Brink BScHons *(Rand Afrikaans), MSc, PhD (Johannesburg)*   Biology
M Brown *BScHons, MSc, PhD (Natal)*   Biology
RJ Burgdorf *BScHons, MSc, PhD (UKZN)*   Biology
P Calverley *BScHons, MSc, PhD (UKZN)*   Biology
C Carbutt *BScHons, MSc, PhD (Natal)*   Biology
F Chidawanyika *BScHons (Zimbabwe), MSc (Stellenbosch), PhD (Witwatersrand)*   Biology
G Cliff *BScHons Natal), MSc (UCT)*   Biology
J Coleman *BScHons (UCT), MSc (Rhodes), PhD (UKZN), HED (UNISA)*   Biology
A Cunningham *BSc(Hons) (Rhodes), MSc (Natal), PhD (UCT)*   Biology
E Di Minin *BScHons (Parma), MSc, PhD (Kent)*   Biology
E Douwes *MSc (UKZN)*   Biology
CD Eardley *BScHons, MSc, PhD (Natal), Hons B Compt (Unisa)*   Biology
J Fattebert *MSc (Neuchatel), PhD (UKZN)*   Biology
AT Forbes *BSCHons, MSc, PhD (Rhodes)*   Biology
L Hart *BSc Hons, PhD (UKZN)*   Biology
L Hunter *BScHons (Monash), PhD (Pretoria)*   Biology
D Jachowski *BS (Montana), MS, PhD (Missouri)*   Biology
L Jordan *BSc Hons (Hert.), MSc (Leeds), PhD (UKZN)*   Biology
S Joshi *BSc Agric, MSc (PDKV), PhD Punjab Agric University*   Biology
R Kyle *BSc Hons (Glasgow), PhD (UN)*   Biology
G Lagendijk *MSc (Wageningen), PhD (UKZN)*   Biology
Lee A *BSc Hons (Wits), PhD (Manchester)*   Biology
ME Light *BScHons, HDE, MSc, PhD (Natal)*   Biology
JGH Londt *BScHons, MSc, PhD (Rhodes)*   Biology
RM Miller *BSc (Muskingum), MA (Kent State), PhD (Iowa State)*   Biology
F Masese *BSc, MSc (Moi), PhD (Wageningen)*   Biology
N Mkhize *BScHons (Agric), MSc (Zululand), PhD (Wageningen)*   Biology
MP Mokoena *BSc (UKZN), BTech (DUT), M MedSc (UKZN), DTech (DUT)*   Microbiology
T Mokotjomela *BScHons, MSc (Witwatersrand), PhD (Stellenbosch)*   Biology
MB Mostovski *MSc (Moscow), PhD (Russian Academy of Sciences)*   Biology
L Mugwedi *Binst Agrar Hons (Pretoria), MSc (Witwatersrand), PhD (UKZN)*   Biology
IV Muratov *BSc, MSc, PhD (Moscow)*   Biology
T Mutanda *BScHons, MSc (Zimbabwe), PhD (Rhodes)*   Microbiology
M Nakhooda *BScHons (UKZN), MSc (Witwatersrand), PhD (UKZN)*   Biology
T Nxele *MSc PhD (UKZN)*   Biology
O'Brien *BScHons (RAU), MSc, PhD (Johannesburg)*   Biology
S O'Donoghue *BScHons (Natal), MSc, PhD (UKZN)*   Biology
L Oellerman *BScHons, MSc, PhD (Rhodes)*   Biology
HD Oschadleus *BScHons, MSc, PhD (UCT)*   Biology
L Pereira *BScHons (Wits), MSc, PhD (Oxford)*   Biology
JD Plisko *MSc, PhD (Warsaw)*   Biology
S Pooley *MA (Uct), MA (Birkbeck), Dphil (Oxford)*   Biology

R Ramesh *BSc (Mumbai Univ.), MSc (Bharathidasan Univ.), PhD (Saurashtra Univ.)*   Biology
S Ramchuran *BTech (ML Sultan), MSc, PhD (Lund)*   Biology
T Ramesh *BSc, MSc (Manonmanium Sundaranar Univ.), PhD (Saurashtra Univ.)*   Biology
D Robertson-Andersson *BScHons, MSc, PhD (UCT)*   Biology
J Selier *BScHons, MSc (UP), PhD (UKZN))*   Biology
N Singh *BScHons, MSc, PhD (UDW,) MBA (UKZN)*   Biology
Y Singh *BScHons (UDW), MSc, PhD (UP)*   Biology
P Sommer *BScHons, PhD (Witwatersrand)*   Genetics
PB Taylor *BScHons (Bristol), PhD (Natal)*   Biology
PJ Taylor *BScHons (UCT), PhD (Natal)*   Biology
L Thompson *BSc Hons (Edinburgh), MSc (Reading), PhD (UKZN)*   Biology
M Trinkel *MSc, PhD (Graz)*   Biology
AT Vanak *MSc (Saurashtra), PhD (Missouri)*   Biology
F Van Langevelde *MSc, PhD (Wageningen)*   Biology
P Wester *PhD (Mainz)*   Biology
O Weyl *BSc Hons, PhD (Rhodes)*   Biology
S Wintner*BScHons, MSc (Munich)*   Biology
C Zachariades *BSc Hons (Witwatersrand), PhD (Rhodes)*   Biology
EP Zweygarth *PG Degree, PhD (Utrecht), Dr Med Vet (Berlin)*   Biology

School of Mathematics, Statistics and Computer Science
Dean and Head of School
Professor D North

Senior Professors
SD Maharaj *BScHons (UDW), MSc, PhD (Witwatersrand), FRSSAf, MASSAf*   Mathematics

Professors
S Bau *BScHons (China) MSc PhD (Otago,NZ)*   Mathematics
KS Govinder *MSc, PhD (Natal), MASSAf*   Mathematics
S Hansraj *JSED (Springfield), BScHons (Unisa), MSc, PhD (Natal)*   Mathematics
F Massamba *BSc, MSc, PGCDG (UCAD Senegal), PGDM (UAC Benin), PhD (ICTP/IMSP Italy/Benin)*   Mathematics
K Moodley *BScHons (UCT), MSc (Natal), PhD (Cantab)*   Mathematics
HG Mwambi *BScHons, MSc, PhD (Nairobi)*   Statistics
P Sibanda *BScHons (Zimbabwe), MSc, PhD (Manchester), MASSAf*   Mathematics
S Viriri *BSc, MSc (Havana), PhD (UKZN)*   Computer Science
TT Zewotir *BSc (Asmara), MSc (Addis Ababa), PhD (Witwatersrand)*   Statistics

Associate Professors
R Goswami *BSc, MSc (IIT Kharagpur), PhD (TIFR India)*   Mathematics
M Hilton *MPhys (Sheffield), PhD (Liverpool John Moores)*   Mathematics
A Maharaj *BPaed (UDW), BAHons, MA, PhD (Unisa)*   Mathematics
OT Mewomo *BScHons (Abeokuta), MSc (Ife), PhD (Abeokuta)*   Mathematics
M Murray *BScHons, MSc, PhD (Natal)*   Statistics
DE North *BScHons, MSc, PhD (Natal)*   Statistics
S Ramroop *BScHons (Natal), MSc (Unisa), PhD (UKZN)*   Statistics
S Ray *BSc, MSc (Calcutta), PhD (Jadavpur)*   Mathematics

Senior Lecturers
G Amery *BScHons, MSc (Natal), MASt, PhD (Cantab)*   Mathematics
K Arunakirinathar *BScHons (Peradenai), MSc (Edinburgh/Heriot Watt), MSc, PhD (UCT)*   Mathematics
R Chifurira *BSc, Dip (Ed), PGDip (Zimbabwe), BScHons (NUST), MSc, PhD (UFS**)*   Statistics
F Habyarimana *MSc, PhD (UKZN)*   Statistics

AE Ezugwu *BSc, MSc, PhD (ABU)* Computer Science
JV Fonou Dombeu *BScHons (Yaoundé 1), MSc (UKZN), PhD (NWU)* Computer Science
SF Melesse *BSc, MSc (Addis Ababa), MSc (Uhasselt), PhD (UKZN)* Statistics
RB Narain *BSc (UKZN), MSc, PhD (Witwatersrand)* Mathematics
N Parumasur *BScHons (UDW), MSc, PhD (Natal)* Mathematics
P Pillay *BScHons, MSc, PhD (UDW)* Mathematics
R Quadir *BScHons, MSc (Dhaka), MS, PhD (Western Ontario)* Mathematics
P Singh *BScHons, MSc (UDW), PhD (Natal)* Mathematics
J-M Tchoukouegno Ngnotchouye *BSc, MSc (Yaoundé 1), PGDip (UWC Aims), PhD (UKZN)* Mathematics
B van Niekerk *BScEng (Natal), MScEng, PhD (UKZN)* Computer Science
R Willie *MSc, PhD, DSc (University Complutense of Madrid)* Mathematics

Lecturers
J M Batidzirai *BSc (Zimbabwe), BScHons, MSc (Fort Hare)* Statistics
O Bodhlyera *BScHons (Zimbabwe), MSc (Essex), PhD (UKZN)* Statistics
R Chifurira *BSc, Dip (Ed), PGDip (Zimbabwe), BScHons (NUST), MSc, PhD (UFS)* Statistics
K Chinhamu *BSc, Dip (Ed), PGDip (Zimbabwe), BScHons (NUST), MSc (UFS)* Statistics
A Desai *BScHons, MSc (UDW)* Statistics
R Els *BSc, BScHons, MSc (Natal), PGCE (UKZN)* Computer Science
SP Goqo *BSc (NWU), BScHons, MSc (UCT)* Mathematics
G Govender *BSc (UDW), BScHons, MSc, PhD (UKZN)* Mathematics
M Gwetu *BSc (Zimbabwe), MSc (NUST)* Computer Science
MJ Hammujuddy *BSc, BScHons (Natal), MSc (UKZN)* Statistics
E Jembere *BScHons, MSc (Zimbabwe)* Computer Science
PR Majozi *BScHons, MSc (UKZN), PGCE (Unisa)* Mathematics
H Mambili-Mamboundou *BSc, MSc (USTM, Gabon), BScHons, PhD (Witwatersrand)* Mathematics
SW Mgobhozi *BSc, MSc, PhD (UKZN)* Mathematics
MD Mhlongo *BSc (UZ), BScHons (Natal), MSc (UCT), PhD (Witwatersrand), HDE (Natal)* Mathematics
S Moopanar *MSc, PhD (Natal)* Mathematics
SS Mthethwa *MSc, PhD (UKZN)* Mathematics
OK Narain *BScHons, MSc (UDW), PhD (Witwatersrand)* Mathematics
MM Nemukula *BSc (UNIVEN), BScHons (UL), MSc (Witwatersrand)* Statistics
AW Pillay *BPaed(Science) (UDW), Dip Datametrics, BScHons (Unisa), MSc (Natal)* Computer Science
K Pillay *BSc, BScHons, MSc (UKZN)* Computer Science
DJ Roberts *BSc, BScHons, MSc (UKZN)* Statistics
SK Shindin *MSc, PhD (Ulyanovsk)* Mathematics
VS Singh *BScHons, MSc (UDW), PhD (Natal)* Mathematics
HM Sithole Mthethwa *BScHons (Stellenbosch), MSc, PhD (UKZN)* Mathematics
L Vorster *MSc (UKZN)* Computer Science
NP Zondo *BScHons, MSc (UKZN)* Statistics

Developmental Lecturers
TP Lephoto *BSc, BScHons, MSc (UKZN)* Statistics
NGZ Mkhize *BScHons (UKZN), MSc (UKZN), MSc (Johannesburg)* Mathematics

Senior Tutors
H Tarr *BScHons, MSc (Natal), PGCE (Unisa)* Mathematics

HONORARY APPOINTMENTS

Emeritus Professors
D Baboolal *BScHons (UDW), MSc, DPhil (Oxon)* Mathematics
J Banasiak *MScEng (Tech Univ of Łodz), PhD (Strathclyde), DSc (Warsaw), MASSAf* Mathematics
EAK Bruning *DiplPhys, Dr rer nat (Gottingen, Priv Doz (Bielefield)* Mathematics
AI Dale *BScHons, MSc (UCT), PhD (VPI & SU), FSASA* Statistics

PGL Leach *BSc, DipEd, BA (Melbourne), MSc, PhD (La Trobe), DSc (Natal), MANS, FRSSAf*   Mathematics
J Moori *BSc (Iran), MSc, PhD (Birmingham)*   Mathematics
RG Ori *BScHons (Unisa), MSc, PhD (Colorado)*   Mathematics
P Pillay *BScHons (UDW), MSc (Chicago), PhD (Witwatersrand)*   Mathematics

Honorary Professors
R Arnab *BScHons, MSc (Calcutta) PhD (Indian Statistical Inst, Calcutta)*   Statistics
A Beesham *MSc, PhD (UCT)*   Mathematics
JM Blackledge *BScHons, PhD (LondonU), DMIT (JyvaskylaU)*   Computer Science
M Bucher *BA (Berkeley), PhD (CIT, Pasadena)*   Mathematics
WM Getz *BScHons, PhD (Witwatersrand)*   Mathematics
SD Ghosh *MPhil, PhD (Negpur)*   Mathematics
JD Key *BSc (Rand), MPhil, PhD (London)*   Mathematics
MA Lachowicz *PhD, DSc (Warsaw)*   Mathematics
W Lamb *BScHons, PhD (Strathclyde)*   Mathematics
SO Manda BScHons (Malawi), MSc (Sheffield), PhD (Waikato)   Statistics
LG Nongxa *BScHons, MSc (Fort Hare), PhD (Oxford)*   Mathematics
B Omolo *MSc (Egerton), PhD (Texas Tech U)*   Statistics
JG Raftery *BScHons, PhD, HDE (Natal)*   Mathematics
BG Rodrigues *BScHons, MSc, PhD (Natal)*   Mathematics
G Sabidussi *BScHons, PhD (Vienna)*   Mathematics
S Shpektotov *PhD (Moscow)*   Mathematics
A Ziegler *FDip Statistics, Mathematics (Munchen), PhD (Dortmund)*   Statistics

Honorary Research Professors
S Chervon *BSc, MSc, PhD (KarzanState), DSc (Tomsk State)*   Mathematics

Honorary Associate Professors
TNO Achia *MSc, PhD (Nairobi)*   Statistics
J Cochran *BScBusAdmin, MSc, MBA (Wright), PhD (Cincinati)*   Statistics
H Gaff *BSc (Indiana), PhD (Tennessee)*   Mathematics
GA Kiker *BSAgEng, MEAgEng, (Florida), PhdAg&BioEng (Cornell)*   Mathematics
S Motsa *BScHons, MSc, PhD*   Mathematics
S Mukwembi *BAHons, MPhil (Zimbabwe), PhD (UKZN)*   Mathematics
JG O'Hara *BSc (Ulster), PGCE, MSc (Belfast), PhD (Witwatersrand)*   Statistics
N Pillay *BScHons, MSc (Natal), PhD (UKZN)*   Computer Science

Honorary Senior Lecturers
C Chiang *MSc, PhD (CALTECH)*   Mathematics
F Chirove *BScHons, MSc (Zim), PhD (Bots)*   Mathematics
C-K Huang *BScHons (Natal), MSc (UKZN), MASt (Cantab)*   Statistics
GB Matthews *BScHons, MSc, PhD (Pretoria)*   Statistics
D Moodley *BSc (UDW), BScHons, MSc (Natal), PhD (UKZN)*   Computer Science
MJ Morgan *BMath(Hons), MMath (Waterloo), PhD (UKZN)*   Mathematics
HC Murrell *BSc (Natal), MSc (Rhodes), PhD (Natal)*   Computer Science
S Naidoo *BComHons, MCom (UKZN), MPhil (Stel), DCom (Pretoria)*   Statistics
PA Winter *MSc, PhD, HDE (Post School), MEd (EdPsych) (Natal)*   Mathematics

Honorary Lecturers
M Jauzac *MSc (Toulouse), PhD (Uprovence)*   Mathematics
P Namayanja *PGDip (AIMS), MSc, PhD (UKZN)*   Mathematics

Senior Research Associate
S Baboolal *BScHons, MSc (UDW), MSc (Dundee), PhD (Natal)*   Computer Science

Honorary Research Fellows
M Govender *BScHons, MSc, PhD (UKZN)*   Mathematics

Centre for Academic Success in Science and Engineering (CASSE)
Director: Professor Naven Chetty

Associate Professor
N Chetty *BScHons (Natal), PhD (UKZN)*   Physics

Senior Lecturer
R Moodley *BScHons (UKZN), MSc (UKZN), PhD (UKZN)*   Chemistry

Lecturers
BG Makhubo *BScHons (UFS), MSc (SU)*   Biology
S Shaik *BPaedSc (UDW), BSc Hons (UDW), MSc (UDW), PhD (UKZN)*   Biology

Senior Tutors
Y Aungamuthu *BSc (Natal), PDHE (UKZN), MEd (UKZN)*   Mathematics
KL Barry *BSc (Natal) BScHons (UKZN), MSc (UKZN)*   Chemistry
G Dawson *BScHons (UPE), MSc (UPE)*   Chemistry
D Haricharan *BA Hons (UDW), MA (UKZN), PhD (UKZN)*   SCOM
MH Hlongwane *BSc (UKZN), BScHons (UKZN), MSc (UKZN)*   Physics
KB Johnson *BScHons (UCT), HDE (UCT), MEd (UKZN)*   Biology
C Koorbanally *BScHons (Natal), MSc (Natal), PhD (Natal)*   Chemistry
N Majola *BSc (UKZN), BScHons (UKZN), MSc (UKZN)*   Physics
B Mshengu *BScHons (UKZN), MSc (UKZN), PhD (UKZN)*   Chemistry
SM Mtshali *BScHons (UKZN), MSc (UKZN)*   Mathematics
S Ntombela *BScHons (UKZN), MSc (UKZN)*   Physics
V Padayachee *JSED (SCE), BA Hons (UNISA), HonsBA (TESOL) (UNISA) MA, PhD (UKZN)* SCOM
H Payne *BScHons (University of Zimbabwe), MSc (UKZN)*   Biology
UM Pillay *BSc (UDW), BScHons (UDW), MSc (UKZN)*   Physics
M Rasalanavho *BSc Hons (UNIVEN), HED (Unisa), Dip Bus Management (Damelin), MSc (UKZN)* Chemistry
P Seaman *BScHons (Rhodes University), MSc (UKZN)*   Biology
V Singh *BSc (Natal), BScHons (UDW), UPGCE (UKZN), MSc, MBA, PhD (UKZN)*   SCOM
MM Tshibangu *BScHons (Lubumbashi), MSc (UKZN), PhD (UKZN)*   Mathematics
E Zhandire *BScHons (NUST), MSc (Reading)*   Physics

Principal Academic Development Officers
KN Hlalukane, *BSc (UKZN) MSc (UKZN)*   Pietermaritzburg (SLS & SMSCS)
A Manival *BSc (UKZN), BScHons (UKZN), MSc (UKZN)*   Pietermaritzburg (SCP & SAEES)
GP Marumure *MEd (Cuba), PGDScEd (Univ of Zim), Dip Trng Mng (IPMZ), MSc (UNISA)* Howard College (Engineering)
B Varghese *BSc, MSc, PhD (Pt. RSU)*   Westville (SLS)
D Varghese *BScAgric (KAU), MScAgric, PhDAgric (UAS)*   Westville (SMSCS)

Senior Academic Development Officer
R Tshibangu *BScEng (UKZN), MScEng (UKZN)*   Westville (SCP & SAEES)

THE UKZN TRANSFORMATION CHARTER

OUR VISION

The vision of the University of KwaZulu-Natal (the University) is "to be the Premier University of African Scholarship". The achievement of this vision is dependent on the transformation of the University.

The notion of transformation which the University embraces is deeper and broader than a narrow categorization based on race and gender representation. It means changing the identity and culture of the University in every aspect of its mission.

Transformation is profoundly advanced by improving the quality of human relationships, and meaningful behavioural change can best bring the identity and culture of the University into alignment with its vision.

OUR ASPIRATIONS

We ASPIRE TO BE a transformed university which:

- Heals the divisions of our nation's past, bridges racial and cultural divides, and lays the foundations for a university that is united in its diversity;

- Promotes high quality research, excellent teaching and learning, and responsible community engagement;

- Promotes African scholarship in every discipline and uBuntu/Botho in its organisational culture;

- Embraces socially and contextually relevant curricula that reflect the University's location in South Africa, Africa and the World;

- Recognises the importance and value of African languages as academic languages;

- Prioritises the well-being and growth of every individual student and staff member;

- Reflects race and gender representation in its management structures, personnel profile, and student population;

- Is socially cohesive and inclusive;

- Is free of discrimination on the basis of ethnicity, race, gender, class, nationality, religion sexual orientation and disability;

- Nurtures collegiality, recognises and respects difference, and celebrates diversity;

- Reflects a new and refreshing culture of tolerance, understanding and vibrant engagement within the University community.

OUR CURRENT CONTEXT

We RECOGNISE that:

- Our transformation has already begun, and that considerable progress has been made;
- The University nevertheless still has much to achieve to realize its transformation objectives.

OUR COMMITMENT

We COMMIT ourselves:

- to the principles and values enshrined in the Constitution of the Republic of South Africa, notably:
  (i) Human dignity, the achievement of equality and the advancement of human rights and freedoms; and
  (ii) Non-racialism and non-sexism.

- to the principles of efficiency, integration and devolution that underpin the Statute of the University;

- to the UKZN PACT, which promotes mutual respect, responsibility, and excellence in teaching and learning;

- to work together until the objectives set out below are manifested in our University.

Therefore, we the staff and students of the University of KwaZulu-Natal adopt this Transformation Charter.

OUR CHARTER

The University shall be a place where:

Research, Teaching, Learning and Scholarship are a Vocation for All

- Access to learning will continue to be promoted to advance social transformation and redress;

- Scholars will pursue their studies in accordance with the principle of freedom of inquiry and research;

- Scholars will advance knowledge and culture through globally-competitive research and scholarship, and research-led teaching and learning;

- Research and curricula will be socially and contextually relevant;

- African languages will be promoted as academic languages;

- The University will be student-centred and provide a caring environment for every student;

- A holistic approach to education, characterized by excellence in teaching and learning, will produce skilled self-confident and socially responsible graduates, conscious of their role in contributing to the national development effort and social transformation.

Race and Gender Representation is Evident in All Structures

- The staff profile of the University at all occupational levels will reflect the demographics of our province and country;

- Gender equity within the management levels of the University will be ensured, and women will be adequately represented in all management structures;

- The implementation of employment equity and the advancement of designated groups within the University structures will be part of the performance management requirements of all line managers;

- Mentorship programmes that develop, support and nurture black and female academic staff members will be provided;

- Mentorship and professional development programmes that attract and retain staff of the highest calibre, develop all staff to their full potential, and meet equity objectives will be developed.

A Socially Cohesive and Inclusive Institutional Culture Thrives

- Social cohesion will be valued and promoted through engagement and understanding, tolerance and respect for diversity in all its forms;

- Every individual will be encouraged to promote social interaction among diverse social groupings, whether among or between staff and students;

- The University will adopt, implement and monitor policies and procedures that aim to eliminate discrimination in all its manifestations including ethnicity, race, gender, nationality, class, religion, sexual orientation and disability;

- Processes will be devised in such a way as to break a code of silence around instances of discrimination in any form;

- Structures and procedures for problem-solving and dispute resolution will be strengthened to handle grievances in a fair and constructive manner;

- The University will enhance on-going education and training for staff and students that sensitises the University community to the lived experiences of its diverse constituencies. It will in this way foster understanding and tolerance, and promote the celebration of diversity;

- The social and personal well-being of staff and students, and an enabling environment for the realization of their full human potential, will be actively promoted.

Good Modes of Governance are Enshrined

- Good corporate governance will be ensured through commitment to democratic representation, devolution, consultation, accountability and transparency;

- Governance, leadership and management will be practiced in a manner that encourages and facilitates positive, proactive, and continuous institutional transformation;

- The University leadership and management will be responsible and directly accountable for creating an environment that cherishes diversity and equity, and which is conducive to respect, tolerance and understanding.

The Right to Freedom of Expression is Guaranteed

- Every individual whether student or staff is a valued member of the University community, and each voice will have the right to be heard;

- Ongoing debate and dialogue on all aspects of transformation and organisational culture will be fostered;

- The University will enhance its role as a leader in transformation by holding regular debates and discussions that will broaden understanding, and identify trends that inhibit and obstruct transformation;

- These engagements will be conducted according to commonly developed "rules of debate" appropriate to a university that espouses critical thinking and well-founded argument;

- Members of Senate will participate actively in debates and discussions and will assume a responsibility in preparing the University for the advent of the broader transformational challenges inherent in global change and the achievement of the University's vision;

- The right to freedom of expression will be counterbalanced by responsibility, accountability and the limitations spelt out within the Constitution of the Republic of South Africa.

Advancement of the Transformation Agenda is the Responsibility of All

- All members of the University community will understand the meaning of transformation and accept individual and collective responsibility for its advancement;

- Leaders within all stakeholder groupings will play a critical role in advancing the transformation agenda;

- Leaders will develop a shared understanding of transformational leadership behaviour, and practice it;

- Key stakeholder groupings will commit to the process of transformation, and contribute actively to it by clearly defining their roles and responsibilities, and improving interpersonal stakeholder relationships at all levels;

- Academics will embrace the notion that universities are places of reflection to extend the boundaries of human existence and will acknowledge the centrality of human relationships in meeting the challenges of our times, and in realising the vision and strategic objectives of the University;

- Students will recognise that they have individual and collective responsibilities to participate in the building of an institutional identity based on mutual respect and tolerance;

- Staff members will take pride in making the University an institution where courtesy; accountability; mutual respect and efficiency are core values.

University of KwaZulu-Natal Pact

We, the staff and students
of the University of KwaZulu-Natal
agree to treat each other with respect,
to abide by the rules and regulations of the institution
and to commit ourselves to excellence in research-led
teaching and learning

Isivumelwano seNyuvesi yaKwaZulu-Natali

Thina, singabasebenzi nabafundi
baseNyuvesi yaKwaZulu-Natali
sivumelana ngokuthi siphathane ngenhlonipho,
silandele yonke imithetho nemigomo yesikhungo
futhi sizibophezela ekufundeni nasekufundiseni
okuholwa ucwaningo nokunobunyoningco

SESSIONAL DATES 2020

HOWARD COLLEGE, PIETERMARITZBURG AND WESTVILLE CAMPUSES

FIRST SEMESTER	Monday, 03 February – Friday, 19 Jun
EASTER VACATION	Saturday, 04 April – Monday, 13 April
WINTER VACATION	Saturday, 20 Jun – Sunday, 12 Jul
SEPTEMBER VACATION	Saturday, 19 Sep – Monday, 28 Sep
SECOND SEMESTER	Monday, 13 Jul – Wednesday, 25 Nov

PRE-SEMESTER:			
	Wed, 01 – Fri, 03 Jan	Thu, 02 Jan	University opens
	Mon, 06 – Fri, 10 Jan	Tue, 07 Jan	(Programme specific) Self-help registration system opens
	Mon, 13 – Fri, 17 Jan		
	Mon, 20 – Sat, 25 Jan	Mon, 20 Jan	Deadline for submission of Exclusion Appeals
			Deadline for applications for remarks
		Fri, 24 Jan	CEACOM (College Exclusion Appeals Com) meetings
		Sat, 25 Jan	Parents' Day
	Mon, 27 – Fri, 31 Jan	Mon, 27 – Fri, 31 Jan	Orientation and on-campus registration of students
		Thu, 30 Jan	AEACOM (Academic Exclusion Appeals Com) meetings

SEMESTER 1:			
1	Mon, 03 – Fri, 07 Feb	Mon, 03 Feb	First Semester commences
			Lectures commence
2	Mon, 10 – Fri, 14 Feb	Fri, 14 Feb	Final date for minimum fee payment required for student registration
			Final date for 1st Semester registration
			Final date for requests for extended DPs

			Final date for submitting curriculum changes
			Registration deadline for returning Research Masters & Doctoral students
3	Mon, 17 – Fri, 21 Feb		
4	Mon, 24 – Fri, 28 Feb		
5	Mon, 02– Fri, 06 Mar		
6	Mon, 09 – Fri, 13 Mar	Fri, 13 Mar	Final day for capturing graduation decisions onto ITS for the students who had outstanding requirements. (Honours, Bachelors, Diplomas and Certificates)
7	Mon, 16 – Sat, 21 Mar	*Sat, 21 Mar*	*Human Rights Day (Public Holiday)*
8	Mon, 23 – Fri 27 Mar	Wed, 25 Mar	Final day for capturing graduation decisions onto ITS (Masters and Doctoral Studies)
		Fri, 27 Mar	Final date for withdrawal from a module
			Final date for withdrawal from the University (Semester 1)
			Final timetable for main & supplementary exams released
9	Mon, 30 Mar – Fri, 03 Apr		
Sat, 04 Apr – Mon, 13 Apr		**EASTER VACATION (STUDENT MID-TERM BREAK)**	
		Fri, 10 Apr	*Good Friday (Public Holiday)*
		Mon, 13 Apr	*Family Day (Public Holiday)*
10	Tue, 14 – Fri, 17 Apr	*Tue, 14 Apr*	*To follow Monday's timetable (Compensatory day)*
		Tue, 14 – Sat, 18 Apr	Graduation Ceremonies (PMB 14&15. WVL 17&18)
		Wed, 15 Apr	*To follow Friday's timetable (Compensatory day)*
11	Mon, 20 – Fri, 24 Apr	Mon, 20 – Fri, 24 Apr	Graduation Ceremonies (WVL)
12	Mon, 27 Apr – Fri, 01	*Mon, 27 Apr*	*Freedom Day (Public Holiday)*

	May	Thu, 30 Apr	Final date for payment of 60% of fees for year registrations or 100% for semester 1 registrations
		Fri, 01 May	*Workers' Day (Public Holiday)*
13	Mon, 04 – Fri, 08 May	Tue, 05 May	Last day for submission of theses/dissertations to the Post-Grad Admin Office for possible 2020 September Graduation
			Final date for submission of 1st Semester Examination Question Papers (Main & Supps) to the Exams Dept.
14	Mon, 11 – Fri, 15 May	Tue, 12 May	DP refusals published
		Wed, 13 May	Lectures end
		Thu, 14 – Mon, 18 May	Study period
		Fri, 15 May	Final date for submission of DP Appeals to School Offices
15	Mon, 18 – Sat, 23 May	Tue, 19 May	First Semester Exams commence (incl. Saturday)
		Sat, 23 May	*Eid-Al-Fitr (condoned absence) (no exams)*
16	Mon, 25 – Sat, 30 May	Mon, 25 – Sat, 30 May	Exam week
17	Mon, 01 – Sat, 06 Jun	Thur, 04 Jun	First Semester Exams end
		Fri, 05 – Wed, 10 Jun	Break between exams
18	Mon, 08 – Sat, 13 Jun	Thu, 11 Jun	1st Semester Supplementary Exams commence
19	Mon, 15 – Fri, 19 Jun	*Tue, 16 Jun*	*Youth Day (Public Holiday observed) (no exams)*
		Fri, 19 Jun	Supplementary Exams end
			First Semester ends

Semester 1:
- Teaching days: Monday 12 , Tuesday 14 , Wednesday 14 , Thursday 13 , Friday 12 : **65 days**
- Compensatory days: (Tuesday 14 April, follows Monday's timetable;   and Wednesday 15 April, follows Friday's timetable)

- Study leave: 5 days;   Main Examinations: 14 days; Supplementary Exams: 7 days.

Sat, 20 Jun – Sun, 12 Jul	MID-YEAR BREAK (Winter Vacation)	
	Mon, 29 Jun	Supplementary Exam marks to be captured on SMS by 12h00
	Tue, 07 Jul	Release of 1st semester results after Exam Boards at 00:01 am

SEMESTER 2:			
1	Mon, 13 – Fri, 17 Jul	Mon, 13 Jul	(Programme specific) Self-help registration system opens
			Second Semester commences
			Lectures commence
		Wed, 15 Jul	Deadline for submission of Exclusion Appeals
		Fri, 17 Jul	CEACOM meetings (College Exclusion Appeals Com.)
			Deadline for applications for re-marks
2	Mon, 20 – Fri, 24 Jul	Tue, 21 Jul	AEACOM meeting (Academic Exclusion Appeals Com.)
		Fri, 24 Jul	Final date for payment of all fees required for student registration (2nd semester).
			Final date for registration – 2nd Semester
			Final date for requests for extended DPs
			Final date for submitting curriculum changes
3	Mon, 27 – 31 Jul		

		Fri, 31 Jul	Eid-Al-Adhah (condoned absence)
4	Mon, 03 – Fri, 07 Aug		
5	Mon, 10 – Fri, 14 Aug	Mon, 10 Aug	National Women's Day (Public Holiday observed)
6	Mon, 17 – Fri, 21 Aug		
7	Mon, 24 – Fri, 28 Aug	Fri, 28 Aug	Final day for capturing graduation decisions onto ITS (all qualifications incl. doctoral studies)
8	Mon, 31 Aug – Fri, 04 Sep	Mon, 31 Aug	Final date for payment of all fees
		Tue, 01 Sep	To follow Monday's timetable (Compensatory day)
9	Mon, 07 – Fri, 11 Sep		
		Fri, 11 Sep	Final date for withdrawal from the University (Sem. 2)
			Final date for withdrawal from a module
			Final timetable for main and supplementary examinations released
10	Mon, 14 – Fri, 18 Sep	Wed, 16 – Thu, 17 Sep	Spring Graduations (All ceremonies held in WVL)
		Sat 19 – Sun, 20 Sep	Rosh Hashanah (condoned absence)
	Sat, 19 Sep – Mon, 28 Sep	STUDENT MID-TERM BREAK	
		Thu, 24 Sep	Heritage Day (Public Holiday)
		Mon, 28 Sep	Yom Kippur (condoned absence)
11	Tue, 29 Sep – Fri, 02 Oct		

12	Mon, 05 – Fri, 09 Oct	Tue, 06 Oct	Final date for submission of 2nd Semester Examination Question Papers (Main & Supps) to the Exams Dept.
13	Mon, 12 – Sat, 17 Oct		
14	Mon, 19 – Sun, 25 Oct	Mon, 19 Oct	DP refusals published
		Tue, 20 Oct	Lectures end
		Wed, 21 – Sun, 25 Oct	Study period
		Thu, 22 Oct	Final date for submission of DP Appeals to School Offices
15	Mon, 26 – Sat, 31 Oct	Mon, 26 Oct	Second Semester Exams commence (incl. Saturday)
16	Mon, 02 – Sat, 07 Nov	Mon, 02 – Sat, 07 Nov	Exam week
		Fri, 30 Oct	Final date for submission of College handbooks for 2021
17	Mon, 09 – Sat, 14 Nov	Tue, 10 Nov	Second Semester Exams end
		Wed, 11 – Tue, 17 Nov	Break between Exams
		Sat, 14 Nov	*Diwali/Deepavali (Condoned absence) (no exams)*
18	Mon, 16 – Sat, 21 Nov	Wed, 18 Nov	2nd Semester Supplementary Exams commence
19	Mon, 23 – Fri, 27 Nov	Wed, 25 Nov	2nd Semester Supplementary Exams end
			Second Semester ends

| 20 | Mon, 30 Nov – Fri, 04 Dec | Mon, 30 Nov | Deadline for internal transfer and re-admission after a break, for entry into the 2021 academic year |
| | | Fri, 04 Dec | Last day for submission of theses/dissertations to the Post-Graduate Administrative Offices for possible April 2021 Graduation |

Semester 2:
- Teaching days: Monday 12 , Tuesday 14 , Wednesday 13 , Thursday 13 , Friday 13 : **65 days**
- Compensatory days: (Tuesday 01 September, follows Monday's timetable)
- Study leave: 5 days;   Examinations: 14 days;   Supplementary Exams: 7 days

YEAR-END BREAK:			
	Mon, 07 – Fri, 11 Dec	Wed, 09 Dec	Supplementary marks to be captured on SMS by 12h00
	Mon, 14 – Fri, 18 Dec	Tue, 15 Dec	Release of 2nd semester results after Exam Boards (00:01 am)
		Wed, 16 Dec	*Day of Reconciliation (Public Holiday)*
	Mon, 21 – Fri, 25 Dec	Thu, 24 Dec	University Offices close (12h00)
		Fri, 25 Dec	*Christmas Day (Public Holiday)*

PLEASE NOTE:

- Sessional Dates for both the School of Medicine and the School of Education will be published separately.
- PGDip(Acc) : Lectures commence on 20 Jan; Final exams will be from 21 to 29 Sep; Supplementaries will be on 02 to 10 Nov; and results will be submitted to SAICA on 27 Nov 2020.
- All Bachelor of Nursing students are required to attend clinical training and community work during vacations in the year from the 06 January 2020 up until the 19 December 2020
- The University of KwaZulu-Natal reserves the right to change any of the said Sessional Dates, solely in its discretion, and without any liability for inconvenience and/or loss occasioned thereby.

ACADEMIC MONITORING AND EXCLUSION

INFORMATION FOR STUDENTS

INTRODUCTION

The Academic Monitoring and exclusions Policy applies to all students registered in undergraduate degrees across all Colleges. An extract from the policy is included below for the information of students.

The Academic Monitoring and Exclusion Policy is based on a system of classifying student academic performance as "good academic standing"; "at risk" or "severely underperforming" with appropriate interventions and actions for each category. Every undergraduate student's performance is assessed at the end of each semester and their status, based on their academic performance at the end of the semester or subsequent supplementary exams, is determined and reflected on the student administration system as "green", "orange" or "red".

The aim of this policy is to enable underperforming students to be identified early and offered academic, personal and careers counselling. Appropriate interventions and systems of support are expected to reduce dropout rates and exclusions and to improve throughputs and completion rates.

Specifically the implementation of this policy means that no academically underperforming student will be excluded from the university in their first year of study. However, it also means that if a student does not respond to support interventions and continues to underperform, s/he will be required to appeal for readmission to the same or a different College after three semesters at university. If readmitted and does not meet set probation requirement while on final probation, then the student will be excluded after four semesters and no further appeals allowed.

Appeals are first considered at College level (CEACOM). All unsuccessful appeals will be referred to a university wide committee (AEACOM) for final decision.

Students will finally be excluded from the university on account of poor academic performance after all other avenues have failed to restore their academic performance to the required level.

Exclusion holds for a minimum period of one year unless otherwise stipulated. Thereafter a student may apply for admission to the same or another College at UKZN if s/he is able to demonstrate that s/he has achieved a level of competence satisfactory to the relevant College or has resolved the personal circumstances that led to poor performance. Admission or readmission will be at the discretion of the College to which the student applies and according their admission requirements. Colleges will specify broad guidelines for what will be deemed satisfactory competence level for readmission.

CLASSIFICATION OF ACADEMIC PERFORMANCE

Each College defines minimum progression requirements, either on a College-wide basis or per qualification or group of qualifications. These are used in categorising academic performance. The categories of academic performance and the consequent interventions and actions are as follows:

Good academic standing (Green)

New students who register for the first time and have not transferred from another College of the university are initially deemed to be of good academic standing and coded green. A student remains coded green provided s/he has passed at least 75% of the maximum expected credit load to date and also has passed 70% or more of the normal credit load this semester. These are regarded as acceptable performance levels; however optional counselling and support is available if requested.

At risk (Orange)

A student who is at risk is required to participate in a compulsory developmental programme including academic counselling, a possible modified curriculum as well as student counselling for personal, life-skills and/or career counselling. A student may be deemed "at risk" when:

- his/her performance is above the applicable minimum progression requirements for that qualification or College but is not at the level of "green", that is, s/he has not passed 75% of the maximum expected credits to date;

- fewer than 70% of the normal credit load has been passed in the current semester.

- credits are below the applicable minimum progression requirements for that qualification or College but the student has been registered for 1 semester only, the student is placed on academic probation with specific and realistic conditions. Even if such a student is performing below the applicable minimum progression requirements s/he will remain at risk (orange) provided s/he continues to meet the set probation requirements which are reviewed each semester

Underperforming (Red)

A student will be coded red when his/her performance falls below the applicable minimum progression requirements for that qualification or College and s/he has been registered for 2 semesters or more. The first time a student becomes "red" s/he is placed on strict academic probation. After **compulsory** academic and personal or career counselling s/he may be permitted to continue in the same qualification or may be advised to redirect to another qualification in the same or another College.

A student will become "red" for a second time if s/he does not achieve the probation conditions set in the previous semester or if, after improving performance for a period, the student again

Academic Monitoring and Exclusion drops below the required levels. In this case, the student must appeal to be readmitted to the same or a different qualification or College. If a student is readmitted following a successful appeal, s/he is placed on final probation with specific conditions to be met and continued academic support.

If a student who was severely underperforming ("red") responds to interventions, achieves probation requirements and eventually works back to good academic standing ("green"), s/he will be deemed to be rehabilitated and the previous period as "red" will not be considered should s/he subsequently lapse.

If a student does not respond to such interventions and s/he continues to underperform s/he must appeal for readmission and may or may not be readmitted on final probation. If readmitted and still does not respond to interventions while on final probation the student will be excluded. No further appeals are allowed.

Students who transfer between qualifications carry their history and academic status with them. Students will normally only be accepted into a new qualification if they are able to complete the new degree in the maximum time permitted for this degree, which includes the semesters they have already spent at UKZN and for which they may have generated credits towards the new degree.

The implementation of the policy is illustrated in the flow diagram below.

UNDERGRADUATE ACADEMIC MONITORING & EXCLUSION POLICY
(to be applied when performance in end of semester examinations is considered)
(Reviewed October 2011)
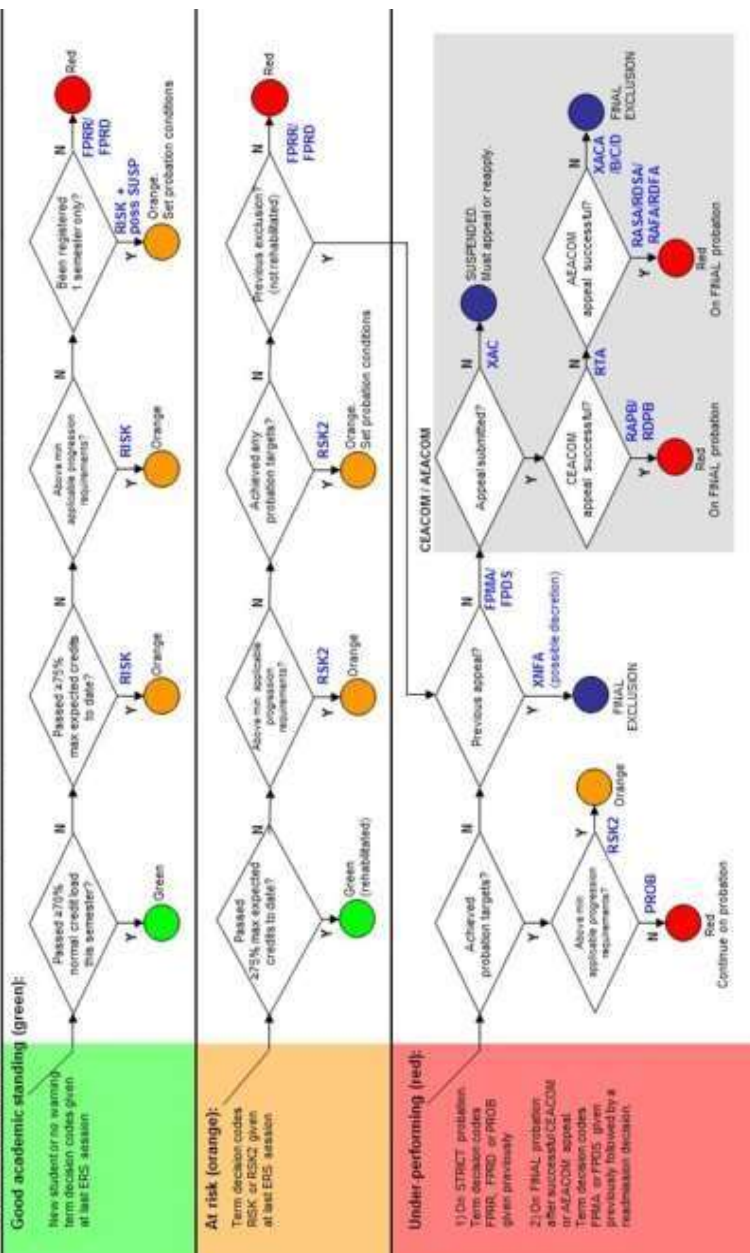
GENERAL INFORMATION FOR STUDENTS

Location

The ***College of Agriculture, Engineering and Science*** comprises the following five Schools:

The School of *Agricultural, Earth and Environmental Sciences*
The School of *Chemistry and Physics*
The School of *Engineering*
The School of *Life Sciences*
The School of *Mathematics, Statistics and Computer Science*

The *School of Agricultural, Earth and Environmental Sciences* is located on the Westville campus and in Pietermaritzburg. However, Geology is available only in Westville while Agriculture, Dietetics and Human Nutrition are in Pietermaritzburg only. The Bachelor of Agriculture in Agricultural Extension is taught at Cedara College of Agriculture near Pietermaritzburg.

The *School of Chemistry and Physics,* the *School of Life Sciences* and the *School of Mathematics, Statistics and Computer Science* are on the Westville campus and in Pietermaritzburg.

The *School of Engineering* is based largely on the Howard College campus. Candidates wishing to study Engineering may complete their first year in Pietermaritzburg. The third and fourth years of Agricultural Engineering are in Pietermaritzburg only.

Degrees and Diplomas

The College offers a wide range of undergraduate and postgraduate qualifications. These are described in the **Rules** and **Syllabi** sections of this handbook, which contain the details of each programme and qualification offered in the College.

Entrance Requirements for Bachelor's Degrees

Entry requirements are dealt with in the **Rules** section. These vary from one qualification to another and some qualifications demand a higher standard in Mathematics and/or Physical Science.

Entry to undergraduate qualifications for candidates with National Senior Certificate are covered in Rules AES-B1 – AES-B2, while e*ntry requirements for applicants with matric qualifications prior to the NSC or foreign qualifications are dealt with in the Rule AES-B4.*

Please note that i**n all College entrance requirements Mathematics Literacy at any level will not act as a substitute for Mathematics.**

Alternative Entry Routes

The College's Access programmes consist of the BSc4 (Augmented) stream, which operates in both Pietermaritzburg and Westville, and the Engineering Access programme at Howard College.

Applicants who have had a disadvantaged school background and who do not meet the normal entry requirements may be considered for admission to the College through one of these routes:

Further details may be found in the **Rules** section.

Postgraduate Study

An applicant may be admitted to postgraduate study in any of the areas of specialisation in the *College of Agriculture, Engineering and Science* provided that the applicant holds an acceptable primary qualification, and provided also that the standard of proficiency previously attained in the intended area is sufficiently high.

Calculation of Points for the National Senior Certificate

Points for the NSC are calculated according to the table below:

NSC Rating	NSC Percentage	NSC Points Rating for UKZN
	90% to 100%	8
7	80% to 89%	7
6	70% to 79%	6
5	60% to 69%	5
4	50% to 59%	4
3	40% to 49%	3
2	30% to 39%	2
1	0% to 29%	1

Note that the points will be calculated from six Subjects **excluding Life Orientation**.

In all College entrance requirements Mathematics Literacy at any level will not act as a substitute for Mathematics.

GENERAL ACADEMIC RULES FOR DEGREES, DIPLOMAS AND CERTIFICATES

(These Rules have been made by the Senate and approved by the Council in terms of the Higher Education Act (Act No. 101 of 1997), as amended.)

PREAMBLE:

(a)   The Council and/or the Senate may from time to time amend, alter or delete any rule, whether a General Rule or a rule relating to a specific module or qualification.

(b)   Where applicable, the interpretation of these Rules is informed by the Definitions of Terms preceding them.

(c)   The provisions of these Rules, as applied in particular colleges, may be restricted in circumstances provided for in the rules of those colleges as approved under Rule GR4.

(d)   Except as otherwise stated or prescribed by the Senate and the Council, Rules GR1 to GR33 shall be applicable to every student of the University of KwaZulu-Natal (hereinafter referred to as "the University").

Definitions of Terms

"academic exclusion" means termination of a student's registration on academic grounds, resulting in exclusion from the university.

"admission" means the act by which the university admits person to study, after acceptance by an applicant of an offer of a place at the University.

"ancillary module" means a module required as a corequisite or prerequisite to a proposed module. All such modules must have been passed before the relevant qualification may be awarded. **Note:** if module A is an ancillary for module B and B is an ancillary for C, then A is necessarily an ancillary for C.

"assessment" means the evaluation and grading of work, supervised or unsupervised, carried out by a student in satisfying the requirements of a module.

"credit points" are a measure of the volume of learning required for a qualification, quantified as a number of notional study hours.

"credit-weighted average" is the average mark of a set of modules weighted in proportion to the credit value of the modules concerned.

"college academic affairs board" means the board established in each college as provided for in the statute and is responsible for the academic and research functions of the school in the college.

"corequisite module" means a module for which a student must register in the same semester as the proposed module, unless the ancillary module has already been passed or attempted with satisfaction of the DP requirements.

"Council" means the Council of the University of KwaZulu-Natal.

"coursework modules" refers to the taught components of all coursework degrees specified in the curriculum and does not include the dissertation or project modules.

"curriculum" means the combination of modules which together comprise the programme of study leading to a qualification. An individual student's curriculum refers to the specific selection of modules within the broad framework of the curriculum prescribed for a qualification, which enables the student to meet the requirements for the qualification.

"degree credits" are used to satisfy the requirements for qualifications. Unless otherwise stated "credits" means degree credits and the term "degree credits" is used only when it is necessary to distinguish them from foundation credits.

"**dissertation**" means a work involving personal research, that is (a) capable of being recorded in any form or medium, and (b) capable of being evaluated, that is submitted for a degree and satisfies degree specific requirements (for doctoral degrees, see "thesis").

"duly performed (DP) requirements" means those college-approved requirements for a module which must be met to permit a student to be eligible for final assessment in that module.

"elective module", means a module that a student selects according to preference from a specified list of module options.

"examination" means a formal assessment, conducted within an officially designated examination session, usually invigilated, and bound by time constraints.

"exit-level module" means a module at the highest level required by the Higher Education Qualifications Framework (HEQF) for a qualification.

"external examination" means examination by a person, external to the university, who has not been involved with teaching including supervision at the University during the previous three (3) years.

"foundation credits" are a measure of the amount of formal foundational material in the curriculum, and may not be used in lieu of degree credits to satisfy the requirements of qualifications.

"full-time student" is a student who is able to devote at least 40 hours a week to their studies and undertake a full credit load of coursework and/or research in each semester.

"independent moderation" means examination by a person, internal or external to the

university, who has not been involved with the teaching of the relevant module in that semester.

"internal examination" means examination by a person or persons involved with the teaching of the relevant module in that semester or, in the case of postgraduate qualifications, is a member of the University academic staff including persons who hold honorary appointments in the University other than the supervisor(s).

"major" means completion of at least 64 credits at exit level and at least 32 credits in the preceding year in that discipline or in any other closely related specified discipline.

"matriculation certificate" means evidence to the satisfaction of Senate of having obtained a National Senior Certificate (NSC) endorsed for Bachelors degrees OR a Matriculation Certificate of the Matriculation Board OR a Matriculation Board Certificate stating that the candidate has satisfied the conditions prescribed by the Board for exemption from the Matriculation Examination.

"module" means any separate course of study for which credits may be obtained and may comprise a dissertation or thesis.

"qualification" means a degree, diploma or certificate.

"part-time student" is one who is unable to devote the required time to their studies and spreads their degree over a longer period, taking fewer credits than the required credit load of a full-time student in each semester.

"prerequisite module" means a module which must have been passed, with at least the minimum mark required, before registration for the proposed module is permitted.

"prerequisite requirement" means that requirement, whether a prerequisite module, a specified mark in a module or any other condition, which must have been met before registration for the proposed module is permitted.

"programme" means a purposeful and structured curriculum leading to a qualification.

"project" means a substantial assignment, whether comprising a single module or part of a module, and which requires research or equivalent independent work by a student.

"registered student" means a student who is registered to study in one or more modules offered by the University. Such registration will lapse on the date of the following registration session or earlier should the student cease to be an admitted student.

"registration" means completion by a student, and acceptance by the University, of a registration form, physical or electronic, and compliance with such other conditions as are required for entitlement to a current student card.

"Senate" means the Senate of the University of KwaZulu-Natal.

"special examination" means an examination awarded by the Senate to a student who has

not been able to attempt or complete the original examination by reason of illness or any other reason deemed sufficient by the Senate. Only the component of the examination which has not been attempted or completed shall be re-written.

"student" means a person who has been admitted to the University for the purpose of studying or who has registered for a qualification. A student remains a student until such time as that person graduates or otherwise completes studies, or withdraws from the University, or fails to attend or register in any semester, or is excluded and all appeal processes for readmission have been exhausted.

"supplementary examination" means an examination awarded by the Senate to a student, based on the student's performance in the original module assessment. All examination papers which constitute the module shall be re-written.

"suspended registration" means an agreement by which the University holds a student's registration in abeyance for a specified period of time.

"tertiary institution" means any institution that provides post-school education on a full-time, part-time or distance basis.

"**thesis**" means a work involving personal research, that is (a) capable of being recorded in any form or medium, and (b) capable of being evaluated, that is submitted for a doctoral degree and satisfies the requirements specified in the relevant rules.

"the University" means the University of KwaZulu-Natal.

"year of study" means the level at which undergraduate students are registered academically.

(a)   *foundation year*: applies to students who are registered in the first year of a foundation programme for a preparatory certificate

(b) *first year of study*: applies to students who have not yet obtained at least 96 (degree) credits

(c) *final year of study:* applies to students in a programme who have registered for such modules as will, if passed, lead to the completion of the qualification.

"working days" means any day of the week but excluding Saturdays, Sundays and public holidays.

General Rules

GR1 Changes in rules

(a) The University may revise or add to its rules from time to time, and any such alteration or addition shall become binding upon the date of publication or upon such date as may be specified by the Council and the Senate, provided that no change in rules shall be interpreted so as to operate retrospectively to the prejudice of any currently registered student.

(b) Any authority granted to colleges under these rules may be further delegated.

GR2 Degrees, diplomas and certificates

The University may confer or award such degrees, diplomas and certificates as approved by the Senate and the Council.

Note: *(a)*   *The list of degrees, diplomas and certificates is available from the Registrar's Office on request.*

     (b)   *Rules for specific qualifications will be found in the relevant college handbooks.*

GR3 Approval of curricula

The Senate, after consultation with the relevant college academic affairs board, shall approve the curricula for all qualifications of the University.

GR4 College rules

Subject to the provisions of the Higher Education Act, the Statute of the University, and the following Rules, the Senate may make or amend rules for each college relating to:

a) the eligibility of a student as a candidate for any qualification and/or module, which may include recognition of prior learning (RPL);

b) the selection process;

c) the period of attendance;

d) the curriculum, work and other requirements for each qualification;

e) progression and academic exclusion; and

f) any other matter relating to the academic functions of the University.

GR5 Application to study

a) Applications to study must be made in such manner as prescribed, and must include presentation of the Matriculation Certificate where this is required.

b) An applicant who has studied at any other tertiary education institution must, in addition, present an academic record and a certificate of conduct from that institution.

GR6 Selection requirements

All applicants shall produce evidence satisfactory to the Senate of their competence to work for the qualification sought. The Senate may decline to admit as a candidate for the qualification any person whose previous academic attainments are, in its opinion, not sufficiently high to warrant such admission.

GR7 Selection for postgraduate studies

a) Graduates of any other recognised university (whether a Public Higher Education Institution in the Republic of South Africa, or elsewhere) may, for the purpose of proceeding to a postgraduate qualification of the University, be admitted by the Senate to a status in the University equivalent to that which they possess in their own university by virtue of any degree held by them.

b) An applicant who has graduated from a South African registered and accredited Private Higher Education Institution or who has in any other manner attained a level of competence which, in the opinion of the Senate, is adequate for the purpose of postgraduate studies or research, may be admitted as a student of the University.

GR8 Exemption from a module

a) Exemption from a module may be granted without credit, where an applicant can demonstrate an equivalent level of competence through prior learning.

b) Exemption and credit from a module may be granted where an applicant has already obtained credit for an equivalent module at this or another recognized university or a South African registered and accredited Private Higher Education Institution.

c) Credit cannot be obtained for more than one module where the contents of the modules overlap or are partially or substantially the same.

GR9 Registration

a) In order to pursue their studies in any semester, all students of the University shall complete the applicable registration procedure, thereby affirming their acceptance of the rules of the University.

b) The Council, on the recommendation of the Senate, may impose conditions for the registration of any student.

c) Except as provided for hereunder, a student shall register in consecutive semesters.

   (i) On application in advance to the relevant college and with the approval of the college academic affairs board, a student's registration may be suspended for a period of time not exceeding 2 semesters. Under exceptional circumstances, a further such suspension of 2 semesters may subsequently be applied for and approved.

(ii)   The deputy vice chancellor and head of college may require that a student suspend his/her studies for a maximum of 1 semester should the student be unable to register for a valid curriculum that will allow satisfactory progress to be made towards the attainment of the qualification.

(iii)   A student with a suspended registration remains subject to the rules of the University, and may return to register before or at expiry of the period of suspension. The period during which registration is suspended shall not be included in and calculation towards the minimum and maximum periods prescribed for any qualification in terms of Rule GR12, nor for the evaluation of eligibility for the award of degrees *cum laude* or *summa cum laude* in terms of Rules BR6, HR8, CR17 and MR13.

d)   Should a student fail to register for a semester:

(i)   In the case of a postgraduate student who has not been granted suspension as provided for in (c) (i) or (ii) above the student must apply to the relevant college for readmission should she/he subsequently wish to return to resume studies. Such readmission shall only be approved under the conditions, rules and curricula applicable at the time of readmission and, in the case of a postgraduate research student, provided that supervisory capacity is available.

(ii)   In the case of an undergraduate student, should the break in studies exceed one semester and the student has not been granted suspension as provided for in (c)(i) or (ii) above, the student must apply to the relevant college for readmission should he/she subsequently wish to return to resume studies. Such readmission shall only be approved under the conditions, rules and curricula applicable at the time of readmission.

e)   (i)   A student may register as a full-time or part-time student (see definitions); such initial registration status shall persist for a minimum period of two semesters after first registration.

(ii)   A part-time student may not register for more than 65% of the normal full-time credit load of coursework modules in each semester unless otherwise provided for in the College rules.

(iii)   In the case of a full-time student who subsequently changes registration status to part-time, the full-time criteria for award of degree cum laude or summa cum laude shall apply;

(iv)   In the case of a student who changes registration status from full-time or vice-versa, the semesters allowed for completion of the qualification will be prorated accordingly.

GR10 Payment of fees

a)   Save by special permission of the Senate and the Council:

    (i)   An applicant shall not be registered until all relevant prescribed fees are paid;

    (ii)   A student shall not be entitled to admission to an examination, nor to receipt of examination results, until all relevant prescribed fees are paid.

b)   A student shall not be entitled to the conferral or award of a qualification until all monies due to the University have been paid.

GR11 Concurrent registration

a)   Save by special permission of the Senate:

    (i)   no student shall be registered for more than one qualification at the same time; nor

    (ii)   shall any student, while registered at any other tertiary institution, be registered concurrently at the University.

GR12 Period of attendance

Every candidate for a qualification shall meet the relevant attendance and performance requirements for each module and qualification as prescribed by the relevant college and approved by the Senate, in order to obtain the requisite credit.

GR13 Module registration

a)   Subject to Rule GR14, no student shall be registered for any module unless his or her curriculum has been approved by the Senate. An approved curriculum may be modified only with the consent of the Senate.

b)   Save by special permission of the Senate, no student may attend a module for which he or she is not registered.

GR14 Ancillary, prerequisite and corequisite requirements

a)   A college may prescribe ancillary modules in any curriculum.

b)   A college may specify the attainment of a minimum mark of more than 50% in a prerequisite module, a specified mark in a module or any other requirement before registration for the proposed module is permitted.

c)   Registration for a module will be conditional on meeting all corequisite and prerequisite requirements for that module.

GR15 Obsolete modules

In readmitting a student, the Senate may withhold recognition, for the purposes of a qualification, of credits previously obtained in modules which have subsequently become obsolete.

GR16 Duly Performed (DP) certification

a)   Students shall not present themselves for examination in any module unless the module co-ordinator / lecturer has certified that they have met the DP requirements for the specified module.

b)   Such DP certification shall be valid only for the examinations, including supplementary examinations, of the semester in which it is issued.

c)   With the consent of the school board concerned, in exceptional circumstances, the DP certification may be extended to the relevant subsequent semester, in which case the board may allow the student to retain the relevant class mark.

d)   The DP requirements for each module shall be published in the college handbook and in any other manner deemed appropriate by the college.

e)   Save as may otherwise be provided by the college, for each module a list of those students refused DP certification shall be published, in a manner deemed appropriate by the college on or before the last day of teaching in each semester.

GR17 DP certification - right of appeal

a)   Students have the right to appeal against the refusal of a DP certification in terms of Rule GR16.

b)   An appeal must be lodged with the relevant school, in the prescribed manner, on or before the date specified in the sessional dates which shall be no less than three (3) working days after the last day of notification of DP refusals.

c)   Such appeal shall be considered by an appropriate committee, the composition of which shall be approved by the Senate**.**

d)   The decision of the committee shall be final.

GR18 Examinations

a)   An examination may be written and/or oral, and may include practical work.

b)   With the approval of the college academic affairs board, a written examination may, for a particular student, be replaced or supplemented by an oral examination.

GR19 External examination and moderation

a)   Except with the permission of the Senate, all modules, other than exit-level modules, shall be subject to internal examination and independent moderation.

b)   Except with the permission of the Senate, all exit-level modules shall be subject to internal and external examination.

c)   The portion of the total assessment subject to independent moderation or external examination, in terms of (a) or (b) above, shall be at least 50%.

GR20 Examination scripts

a)   To aid academic development, students may view their examination scripts under supervision.

b)   (i)   A student may, on formal application and after payment of the applicable fee, have all his/her examination scripts for a module re-marked, normally by the original examiners, in accordance with the policies approved by the Senate and the Council.

     (ii)   Such application shall be lodged with the relevant school office, in the prescribed manner, on or before the date in the sessional dates.

     (iii)   The student's final mark for the module shall be that determined by the re-mark.

     (iv)   The fee shall be refunded only if the re-mark causes an improvement in the class of result as reflected in Rule GR29(a).

c)   Re-marking as contemplated in (b) above shall not be permitted for honours and equivalent projects, master's dissertations and doctoral theses.

d)   Examination scripts shall be stored by the University for a maximum period of one (1) year or such longer period required by contractual or professional obligations.

GR21 Examination sessions

All examinations shall be held in the prescribed sessions approved by the Senate.

GR22 Supplementary examinations

Supplementary examinations may be awarded in terms of these rules and the relevant college rules. Supplementary examinations shall not be awarded for any continuously assessed modules or components of modules.

GR23 Special examinations

a)   An undergraduate student may elect to write all the examination papers for a particular module in either the main or supplementary examination session, provided that such a supplementary examination is scheduled. The provisions of rule GR25(b) shall apply.

b)   A student who has not been able to complete the original final examination by reason of illness or any other reason deemed sufficient by the Senate, may, on application, be granted permission to sit a special examination, during the next applicable supplementary examination session.

c)   An application for a special examination shall be made on the prescribed form, accompanied by all relevant documentation, and lodged in the relevant college within five (5) working days of the date of the examination concerned. It is the responsibility of the student to ascertain whether or not the special examination has been granted.

d)   If an application for a special examination is approved, the examination result, if any, from

the original examination shall be regarded as null and void. If such an application is not approved the original examination result shall stand.

GR24 Standard of supplementary and special examinations

To pass supplementary and special examinations, students must demonstrate a level of academic competence equivalent to that required in the original examination.

GR25 Limitation on awarding supplementary and special examinations

a) A supplementary or special examination shall not be granted in respect of any supplementary examination awarded in terms of Rule GR22.
b) A supplementary or special examination shall not be granted in respect of any special examination awarded in terms of Rule GR23.

GR26 Completion of modules

Every module shall be completed by passing the Senate-approved assessment in that module.

GR27 Pass mark

The pass mark for all modules in the University shall be 50%, provided that any sub-minima required in certain components of the Senate-approved assessment have been met.

GR28 Completion requirements

Save by special permission of the Council, upon the approval of the Senate, a qualification shall not be conferred or awarded until:
a) credit has been obtained for all prescribed modules, including prerequisite and corequisite modules;
b) all other Senate and college requirements have been met; and
c) all monies due to the University have been paid.

GR29 Classification of results

a) Results may be classified as follows:
75% upward = 1st class;
70 – 74%. = 2nd class, upper division;
60 – 69% = 2nd class, lower division;
50 – 59% = 3rd class;
less than 50% = fail.
Based on the credit weighted average of all modules passed.
b) For Bachelors and Honours degrees, the academic record of the student shall reflect the class of pass if the student has obtained a pass in the first class or in the second class upper division.

c)   On the recommendation of the school board, a module may be passed with such distinctions as may be prescribed by the Senate.
d)   On the recommendation of the college academic affairs board, a qualification may be conferred or awarded with such distinctions as may be prescribed by the Senate.

GR30 Academic exclusion

a)   The Council may, with the approval of the Senate, after each examination session exclude or refuse to renew or continue the registration of a student who has failed to meet the academic requirements for continued registration.
b)   The Senate may cancel the registration of a student in all or one or more of the modules for which the student is registered in a semester if, in the opinion of the Senate, the academic achievement of the student is such that the student may not at the end of the semester obtain credit in such module or modules.
c)   The Council may, with the approval of the Senate, refuse readmission to a student who fails to satisfy the minimum requirements for readmission.
d)   Subject to Rule GR31, students excluded or refused re-registration may not be readmitted to the University until they are able to demonstrate that they have achieved a level of competence satisfactory to the relevant college and the Senate.

GR31 Academic exclusion – right of appeal

a)   Students have the right to a single appeal against academic exclusion in terms of Rule GR30.
b)   Such appeal shall be lodged with the college of registration, in the prescribed manner, on or before the date in the sessional dates.
c)   The process for consideration of such an appeal shall be approved by the Senate.

GR32 Ethics

All academic activities and research in particular, shall comply with the relevant University policies on ethics and any related requirements as determined by the Senate and the Council.

GR33 Reproduction of work

Subject to the provisions of the University's policy on intellectual property rights and any limitations imposed by official contractual obligations:
a)   In presenting an assignment, prescribed project, dissertation, thesis or any such work for assessment, a student shall be deemed by so doing to have granted the University a perpetual, non-exclusive, royalty-free licence to digitise, reproduce, share, disseminate and/or publicly distribute copies thereof for research and study purposes only, in whole or in part and in any format the University deems fit, provided that the University may waive its rights under this licence if the work in question has been or is being published in a

manner satisfactory to the University.

b) Students shall forward master copies and electronic copies of all treatises, dissertations and theses to the University libraries by the date, in the numbers and in the format stipulated by the libraries in their policies existing at the time of creation of the treatise, dissertation or thesis concerned.

c) The work of students shall not be included in publications by academic staff without their express permission and acknowledgement; provided that such work may be included and acknowledged if all reasonable attempts to trace such students have been unsuccessful.

Rules for Bachelors Degrees

Note: The following Rules are additional to the preceding General Rules GR1 – GR33.

BR1 Applicability

The following Rules, BR2 to BR6 inclusive, shall be applicable to every candidate for a Bachelors Degree.

BR2 Criteria for admission to study

a) Applicants for a first or primary degree for which the Matriculation Certificate is a prerequisite, shall produce evidence to the satisfaction of the Senate that they have obtained such a certificate, or obtained a certificate of conditional exemption issued by the Matriculation Board to applicants from countries outside the Republic of South Africa, or satisfied the conditions of any alternative admission process approved by the Senate.

b) In addition to the requirements of a) above, the minimum requirements for admission to study in any college may include the requirement to have attained such minimum standard in a specified subject or subjects or such aggregate of points scored according to subjects passed in the Matriculation Examination, or in an examination recognised for the purpose by the Matriculation Board, or such other qualifications as may be prescribed. The selection process will be based on these requirements and may include academic ranking and other criteria as approved by the Senate and the Council.

BR3 Periods of attendance

Every candidate for a first or primary degree, shall be registered as a matriculated student, except as provided in Rule BR2, and have completed subsequent to the date of validity of the Matriculation Certificate or of the certificate of full exemption from the matriculation examination issued by the Matriculation Board, the minimum period of attendance prescribed by the rules of the relevant college.

BR4 Recognition of attendance

For the purpose of Rules GR12 and BR3, the Senate may accept as part of the attendance of a student for a degree of Bachelor, periods of attendance as a registered matriculated student at any other university or tertiary institution or in any other college in the University: provided that students shall not have the degree of Bachelor conferred unless:

a) their periods of attendance are together not less than the complete period prescribed for such degree; and

b) they attended at the University:

    (i)   for a degree of Bachelor, the term of which is six semesters, at least three semesters which shall include the completion of at least half of the total number of credits prescribed for the degree and which, except with the approval of the Senate, shall include all those at the exit level; or

    (ii) for a degree of Bachelor, the term of which is eight semester, at least four semesters which shall include the completion of at least half of the total number of credits prescribed for the degree and which, except with the approval of the Senate, shall include all those at the exit level; or

    (iii) for a degree of Bachelor, the term of which is ten or twelve semesters, at least six semesters which, except with the approval of the Senate, shall include the completion of all modules prescribed for the final six semesters of the curriculum.

BR5 Progression under conditional exemption

Applicants who are accepted with an ordinary conditional exemption that requires completion of additional credits to qualify for exemption, shall not be permitted to register for any module at level 3 or above before the requirements for exemption have been satisfied.

BR6 Supplementary examinations

Provided that the rules of any college do not prohibit this for a particular module:

a) a student who fails a module with a mark of at least 40%, or who obtains a passing mark less than that prescribed for registration for another module, shall be awarded a supplementary examination;

b) under exceptional circumstances, and with the permission of the college academic affairs board, a student who has failed a module with a mark of less than 40% may be awarded a supplementary examination.

BR7 Award of degree *cum laude* and *summa cum laude*

a) A degree of Bachelor may be conferred *cum laude* in accordance with the rules of the relevant college, provided that, subject to exceptions as approved by the college

academic affairs board, the student has:
- (i)   obtained a credit-weighted average of at least 75% in those modules required for the qualification; and
- (ii)   successfully completed all modules in the curriculum at the first attempt and without recourse to supplementary examinations; and
- (iii) completed the degree in the prescribed minimum time.

b)   A degree of Bachelor may be conferred *summa cum laude* in accordance with the rules of the relevant college, provided that, subject to exceptions as approved by the college academic affairs board, the student has:
- (i)   obtained a credit-weighted average of at least 80% in those modules required for the qualification; and
- (ii)   successfully completed all modules in the curriculum at the first attempt and without recourse to supplementary examinations; and
- (iii) completed the degree in the prescribed minimum time.

BR8 Deans Commendation

A student who is registered for the full load required for that qualification in a particular semester and passes all these modules at the first attempt, with no individual module mark of less than 60% and a credit-weighted average mark of at least 75%, will be awarded a Dean's commendation for that semester.

BR9 Completion of isiZulu module

For a degree of Bachelor, a student must either pass an approved module in isiZulu; or obtain exemption from the module under GR8a (competence through prior learning) in which case any shortfall in credit for the degree shall be made up; or obtain exemption and credit for the module under GR8b (an equivalent module has been passed).

Rules for Honours Degrees

Note: The following Rules are additional to the preceding General Rules GR1 – GR33.

HR1 Applicability

The following Rules, HR2 to HR8 inclusive, shall be applicable to every candidate for a degree of Honours.

HR2 Criteria for admission to study

a)   Applicants may be registered for the qualification of Honours provided that they have:
- (i)   completed a Bachelors degree regarded as appropriate by the college concerned; or

    (ii)   been admitted to the status of that degree in terms of Rule GR7(a); or

    (iii)   attained a level of competence as defined in Rule GR7(b).

b)   A college may prescribe further minimum criteria for admission to study.

HR3 Attendance

a)   Every student for a qualification of Honours shall attend an approved course of study as a registered student of the University for a period of at least two consecutive semesters after admission in terms of Rule HR2.

b)   Except with by permission of the college academic affairs board, all modules shall be completed at the University.

HR4 Curriculum

The curriculum for a qualification of Honours shall include a prescribed research project as one of the modules which shall account for a minimum of 25% of the credits for the degree.

HR5 Supplementary examinations

Provided that the rules of a college do not prohibit this for a particular module:

a)   a student who fails a module other than the research prescribed project with a mark of at least 40% shall be awarded a supplementary examination; and

b)   under exceptional circumstances, and with the permission of the college academic affairs board, a student who has failed a module other than the research project with a mark of less than 40% may be awarded a supplementary examination.

HR6 Re-examination of prescribed project

Provided that the rules of a college, do not prohibit this, a research project that is assessed as unsatisfactory may be referred back once for revision and resubmission before the last day of examinations in that semester.

HR7 Progression

a)   A student may repeat a failed coursework module not more than once.

b)   Under exceptional circumstances, on the recommendation of the relevant School, the College Academic Affairs board may give permission to a student who has failed the prescribed project described in Rule HR4, to register for the research project module once more, with a new research topic.

c)   A student who, after four semesters as a full time student or six semesters as a part-time student, has not completed the requirements for the degree, shall be excluded

HR8 Award of degree *cum laude* and *summa cum laude*

a)   A degree of Honours may be conferred *cum laude* in accordance with the rules of the relevant college, provided that, subject to exceptions as approved by the college academic affairs board, the student has:
   (i)   obtained a credit-weighted average of at least 75% in those modules required for the qualification; and
   (ii)   a mark of at least 75% for the prescribed project; and
   (iii) successfully completed all modules in the curriculum without recourse to supplementary examinations; and
   (iv)   completed the degree in the prescribed minimum time for a full-time student, or minimum time plus two semesters for a part-time student.

b)   A degree of Honours may be conferred *summa cum laude* in accordance with the rules of the relevant college, provided that, subject to exceptions as approved by the college academic affairs board, the student has:
   (i)   obtained a credit-weighted average of at least 80% in those modules required for the qualification; and
   (ii)   a mark of at least 80% for the prescribed project; and
   (iv)   successfully completed all modules in the curriculum without recourse to supplementary examinations; and completed the degree in the prescribed minimum time for a full-time student, or minimum time plus two semesters for a part-time student.

Rules for Postgraduate Diplomas

Note: The following Rules are additional to the preceding General Rules GR1 – GR33.

PR1 Applicability

The following Rules, PR2 to PR8 inclusive, shall be applicable to every candidate for a Postgraduate Diploma

PR2 Criteria for admission to study

a)   Applicants may be registered for the qualification of Postgraduate Diploma provided that they have:
   (i)   completed a Bachelors degree regarded as appropriate by the college concerned; or
   (ii)   been admitted to the status of that degree in terms of Rule GR7(a); or
   (iii) attained a level of competence as defined in Rule GR7(b).

b)   A college may prescribe further minimum criteria for admission to study.
c)   A college may provide in its rules for an appropriate Advanced Diploma to be accepted for entry to a Postgraduate Diploma in accordance with the HEQF.

PR3 Attendance

a)   Every student for the qualification of Postgraduate Diploma shall attend an approved course of study as a registered student of the University for a period of at least two consecutive semesters after admission in terms of Rule PR2.
b)   Except with the permission of the college academic affairs board, all modules shall be completed at the University.

PR4 Curriculum

The curriculum for the Postgraduate Diploma will contain advanced reflection, practice and research methods in the area of specialisation and may include a sustained research project in accordance with college rules.

PR5 Supplementary examinations

Provided that the rules of a college do not prohibit this for a particular module:
a)   a student who fails a module other than the research prescribed project with a mark of at least 40% shall be awarded a supplementary examination; and
b)   under exceptional circumstances, and with the permission of the college academic affairs board, a student who has failed a module other than the research project with a mark of less than 40% may be awarded a supplementary examination.

PR6 Re-examination of research project

Provided that the rules of a college do not prohibit this, a research project that is assessed as unsatisfactory may be referred back once for revision and resubmission before the close of the applicable supplementary examination session.

PR7 Progression

a)   A student may repeat a failed coursework module not more than once.
b)   Under exceptional circumstances, on the recommendation of the relevant School, the College Academic Affairs board may give permission to a student who has failed the prescribed project described in Rule PR4, to register for the research project module once more, with a new research topic.
c)   A student who, after four semesters as a full time student or six semesters as a part-time student, has not completed the requirements for the degree, shall be excluded.

PR8 Award of diploma with distinction

A qualification of Postgraduate Diploma may be conferred with distinction in accordance with the rules of the relevant college, provided that, subject to exceptions as approved by the college academic affairs board, the student has:

(i) obtained a credit-weighted average of at least 75% over all modules required for the qualification; and

(ii) successfully completed all modules in the curriculum without recourse to supplementary examinations; and

(iii) completed the diploma in the prescribed minimum time for a full-time student, or minimum time plus two semesters for a part-time student.

Rules for Masters Degrees by Coursework

Note: The following Rules are additional to the preceding General Rules GR1 – GR33.

CR1 Applicability

The following Rules, CR2 to CR17 inclusive, shall be applicable to every candidate for a degree of Master by coursework.

CR2 Criteria for admission to study

a) An applicant shall not be registered for the degree of Master by coursework unless the applicant has:

(i) satisfied the requirements for a relevant prerequisite degree as specified in the college concerned; or

(ii) been admitted to the status of that degree in terms of Rule GR7(a); or

(iii) attained a level of competence as defined in Rule GR7(b).

b) A college may prescribe further minimum criteria for admission to study.

CR3 Recognition of examinations

The Senate may accept examinations passed or certificates of proficiency completed in any module by a student of the University or of any other university or institution recognised by the Senate for this purpose, or accept demonstration of an equivalent level of competence through prior learning, in terms of Rule GR7(b), as exempting the student from examination in module(s) prescribed for a degree of Master by coursework, provided that:

a) no more than 50% of the required credits for the degree may be so exempted, provided that such credits shall be awarded for coursework modules only; and

b) students shall not have the degree of Master conferred unless the conditions laid down in Rules CR4 and CR5 are satisfied.

CR4 Periods of registration

A student registered for the degree of Master by coursework shall be so registered for a minimum period of two consecutive semesters before the degree may be conferred.

CR5 Recognition of attendance

The Senate may accept as part of the attendance of a student for a degree of Master by coursework, periods of attendance as a registered or graduated student at any other university or institution or in any other college, provided that students shall not have the degree of Master conferred unless:
a)   their periods of attendance are together not less than the complete period prescribed for conferral of the degree; and
b)   the research component is completed at the University.

CR6 Curriculum

a)   A student shall complete all prescribed modules, at least one of which shall be a dissertation module comprising research on a particular topic approved by the college academic affairs board, and comply with such other conditions as may be prescribed by the Senate and the rules of the college concerned.
b)   Except with the permission of Senate, the dissertation module shall comprise 33% to 50% of the total credits for the degree.

CR7 Proposed research topic

a)   The college academic affairs board may, at its discretion, decline to approve a research topic if in its opinion:
     (i)   it is unsuitable in itself; or
     (ii)   it cannot effectively be undertaken under the supervision of the University; or
     (iii)   the conditions under which the student proposes to work are unsatisfactory.
b)   Ethical approval in terms of Rule GR32 is required where applicable.

CR8 Supervision

The school board shall, in terms of the policies of the Senate, appoint one or more appropriate supervisors, at least one of whom shall be a member of the University academic staff, to advise a student whose research topic is approved, and the student shall be required to work in such association with the supervisor or supervisors.
CR9 Supplementary examinations
Provided that the rules of a college do not prohibit this for a particular module:
a)   a student who fails a module other than the dissertation with a mark of at least 40% shall be awarded a supplementary examination;
b)   under exceptional circumstances, and with the permission of the college academic affairs

board, a student who has failed a module other than the dissertation with a mark of less than 40% may be awarded a supplementary examination.

CR9 Supplementary examinations

Provided that the rules of a college do not prohibit this for a particular module:
b)   a student who fails a module other than the dissertation with a mark of at least 40% shall be awarded a supplementary examination;
b)   under exceptional circumstances, and with the permission of the college academic affairs board, a student who has failed a module other than the dissertation with a mark of less than 40% may be awarded a supplementary examination.

CR10 Failed coursework modules

Failed coursework modules may not be repeated, except with the permission of the College Academic Affairs Board.

CR11 Progression

A student who, after four semesters as a full-time student or six semesters as a part-time student, has not completed the requirements for the degree shall be required to apply for re-registration, which will only be permitted on receipt of a satisfactory motivation.

CR12 Submission of dissertation

At least three months before the dissertation is to be submitted for examination, a student shall give notice, in writing, of their intention to submit such dissertation and the title thereof, provided that, in the event of a student failing to submit the dissertation for examination within six months thereafter, the notice will lapse and a further notice of intention shall be submitted.

CR13 Format of dissertation

a)   Every dissertation submitted shall include a declaration to the satisfaction of the Senate stating that it has not previously been submitted for a degree in this or any other university, and that it is the student's own original work.
b)   Every dissertation submitted shall be in such format as prescribed by the Senate and the rules of the relevant college; provided that each dissertation shall include an abstract in English not exceeding 350 words.
c)   A dissertation may comprise one or more papers of which the student is the prime author, published or in press in peer-reviewed journals approved by the relevant college academic affairs board or in manuscripts written in a paper format, accompanied by introductory and concluding integrative material.

d) A dissertation submitted under (c) above shall include a detailed description of the student's own distinct contribution to the papers.
e) All dissertations are subject to full examination in terms of these rules, the rules of a college and the normal policies and procedures applicable to dissertations.

CR14 Supervisor's report

Upon submission of the dissertation, the supervisor or supervisors shall furnish a report on the conduct of the student's work; the report shall not include an evaluation of the quality of the dissertation.

CR15 Examination of dissertation

a) The college academic affairs board shall appoint for each dissertation two examiners, at least one of whom shall be responsible for external examination.
b) A supervisor or co-supervisor shall not be appointed as an examiner.
c) The names of the examiners shall not be known to either the candidate or to one another.

CR16 Re-examination of dissertation

A failed dissertation may not be re-examined.

CR17 Award of degree *cum laude* and *summa cum laude*

The degree of Master by Coursework may be awarded *cum laude or summa cum laude o*n the recommendation of the examiners of the dissertation and, in accordance with rules of the college provided that, subject to exceptions approved by the college academic affairs board,
a) For *cum laude*:
    i) the student has obtained a credit weighted average of at least 75% in the coursework component of the degree at the first attempt and without recourse to supplementary examinations; and
    ii) the degree was completed in the prescribed minimum time plus two semesters for a full-time student, or minimum time plus four semesters for a part-time student.
b) For *summa cum laude*:
    i) the student has obtained a credit weighted average of at least 80% in the coursework component of the degree at the first attempt and without recourse to supplementary examinations; and
    ii) the degree was completed in the prescribed minimum time for a full-time student, or minimum time plus two semesters for a part-time student.

Rules for Masters Degrees by Research

Note: The following Rules are additional to the preceding General Rules GR1 – GR33.

MR1 Applicability

The following Rules, MR2 to MR13 inclusive, shall be applicable to every candidate for a degree of Master by research.

MR2 Criteria for admission to study

a)   An applicant shall not be registered for the degree of Master by research unless the applicant has:
   (i)   satisfied the requirements for a relevant prerequisite degree as specified in the college concerned; or
   (ii)   been admitted to the status of that degree in terms of Rule GR7(a); or
   (iii) attained a level of competence as defined in Rule GR7(b).
b)   A college may prescribe further minimum criteria for admission to study.

MR3 Periods of registration

A student registered for the degree of Master by research shall be so registered for a minimum period of two consecutive semesters before the degree may be conferred.

MR4 Curriculum

a)   A student for the degree of Master by research shall be required to pursue an approved programme of research on some subject falling within the scope of the studies represented in the University.
b)   A student shall also comply with such other conditions as may be prescribed by the Senate and the rules of the college concerned.

MR5 Proposed subject of study

a)   Before registration, an applicant for the degree of Master by research shall submit for the approval of the college academic affairs board a statement of the proposed subject of study.
b)   The college academic affairs board may, at its discretion, decline to approve such subject if, in its opinion:
   (i)   it is unsuitable in itself, or
   (ii)   it cannot profitably be studied or pursued under the supervision of the University, or

(iii)   the conditions under which the applicant proposes to work are unsatisfactory.

c) Ethical approval in terms of Rule GR32 is required where applicable.

MR6 Supervision

The school board shall, in terms of the policies of the Senate, appoint one or more appropriate supervisors, at least one of whom shall be a member of the University academic staff, to advise a student whose research topic is approved, and the student shall be required to work in such association with the supervisor or supervisors.

MR7 Progression

A student who, after four semesters as a full-time student or six semesters as a part-time student, has not completed the requirements for the degree shall be required to apply for re-registration, which will only be permitted on receipt of a satisfactory motivation.

MR8 Submission of dissertation

a) Every student for the degree of Master by research shall be required to submit a dissertation embodying the results of their research.

b) At least three months before the dissertation is to be submitted for examination, a student shall give notice, in writing, of their intention to submit such dissertation and the title thereof, provided that, in the event of a student failing to submit the dissertation for examination within six months thereafter, the notice will lapse and a further notice of intention shall be submitted.

MR9 Format of dissertation

a) Every dissertation submitted shall include a declaration to the satisfaction of the Senate stating that it has not previously been submitted for a degree in this or any other university, and that it is the student's own original work.

b) Every dissertation submitted shall be in such format as prescribed by the Senate and the rules of the relevant college; provided that each dissertation shall include an abstract in English not exceeding 350 words.

c) A dissertation may comprise one or more papers of which the student is the prime author, published or in press in peer-reviewed journals approved by the relevant college academic affairs board or in manuscripts written in a paper format, accompanied by introductory and concluding integrative material.

d) A dissertation submitted under (c) above shall include a detailed description of the student's own distinct contribution to the papers.

e) All dissertations are subject to full examination in terms of these rules, the rules of a college and the normal policies and procedures applicable to dissertations.

MR10 Supervisor's report

Upon submission of the dissertation, the supervisor or supervisors shall furnish a report on the conduct of the student's work; the report shall not include an evaluation of the quality of the dissertation.

MR11 Examination

a)   The college academic affairs board shall appoint for each dissertation two examiners, at least one of whom shall be responsible for external examination.
b)   A supervisor or co-supervisor shall not be appointed as an examiner.
c)   the names of the examiners shall not be known to either the candidate or to one another.

MR12 Re-examination of dissertation

A failed dissertation may not be re-examined.

MR13 Award of degree *cum laude* and *summa cum laude*

The degree of Master by research may be awarded cum *laude or summa cum laude* on the recommendation of the examiners, and in accordance with rules of the relevant college provided that the degree was completed:

a)   For *cum laude*: in the prescribed minimum time plus two semesters for a full-time student, or minimum time plus four semesters for a part-time student.
b)   For *summa cum laude*, in the prescribed minimum time for a full-time student, or minimum time plus two semesters for a part-time student.

Rules for the Doctoral Degree by Research

Note: The following Rules are additional to the preceding General Rules GR1 – GR33.

DR1 Applicability

The following rules, DR2 to DR13 inclusive, shall be applicable to every candidate for a Doctoral degree.

DR2 Criteria for admission to study

a)   An applicant shall not be registered for a Doctoral degree unless the applicant has:
  (i)   satisfied the requirements for a relevant prerequisite degree as specified in the college concerned; or
  (ii)   been admitted to the status of that degree in terms of Rule GR7(a); or
  (iii) attained a level of competence as defined in Rule GR7(b).
b)   A college may prescribe further minimum criteria for admission to study.

c)   Candidates, registered for a research Masters degree, who have completed the requirements for the Masters degree, may apply to have their registration converted to a Doctoral degree registration before the Masters degree is awarded. The time allowed for the Doctoral degree would be reduced by two semesters. The material from the Masters dissertation may then be used towards the Doctoral degree. If the Doctoral degree is not completed, the Masters degree will be awarded.

DR3 Periods of registration

A student registered for a Doctoral degree shall be so registered for a minimum period of four semesters before the degree may be conferred.

DR4 Curriculum

a)   A student for a Doctoral degree shall be required to pursue an approved programme of research on some subject falling within the scope of the studies represented in the University.
b)   Such programme shall make a distinct contribution to the knowledge or understanding of the subject and afford evidence of originality shown either by the discovery of new facts and/or by the exercise of independent critical power.
c)   A student shall also comply with such other conditions as may be prescribed by the Senate and the rules of the college concerned.

DR5 Proposed subject of study

a)   Before registration, an applicant for a Doctoral degree shall submit for the approval of the college academic affairs board a statement of the proposed subject of study.
b)   The Senate may, at its discretion, decline to approve such subject if, in its opinion:
     (i)   it is unsuitable in itself, or
     (ii)   it cannot profitably be studied or pursued under the supervision of the University, or
     (iii) the conditions under which the applicant proposes to work are unsatisfactory.
c)   Ethical approval in terms of Rule GR32 is required where applicable.

DR6 Supervision

The school board shall appoint one or more appropriately qualified supervisors, at least one of whom shall be a member of the University staff, to advise a student whose research topic is approved, and the student shall be required to work in such association with the supervisor or supervisors.

DR7 Progression

A student who, after eight semesters as a full-time student or ten semesters as a part-time student, has not submitted a thesis for examination shall be required to apply for reregistration, which will only be permitted on receipt of a satisfactory motivation.

DR8 Submission of thesis

a) Every student for a Doctoral degree shall be required to submit;
   (i)   a thesis embodying the results of their research, together with
   (ii) one (1) published paper or an unpublished manuscript that has been submitted to an accredited journal, arising from the doctoral research unless the thesis is in the format as described in DR9 c).

b) At least three months before the thesis is to be submitted for examination, a student shall give notice, in writing, of their intention to submit such thesis and the title thereof, provided that, in the event of a student failing to submit the thesis for examination within six months thereafter, the notice will lapse and a further notice of intention shall be submitted.

DR9 Format of thesis

a) Every thesis submitted shall include a declaration to the satisfaction of the Senate stating that it has not previously been submitted for a degree in this or any other university, and that it is the student's own original work.

b) Every thesis submitted shall be in such format as prescribed by the Senate and the rules of the relevant college; provided that each thesis shall include an abstract in English not exceeding 350 words.

c) A thesis may comprise one or more original papers of which the student is the prime author, published or in press in peer-reviewed journals approved by the college academic affairs board, accompanied by introductory and concluding integrative material.

d) A thesis submitted under c) above shall include a detailed description of the student's own distinct contribution to the papers.

DR10 Supervisor's report

Upon submission of the thesis, the supervisor or supervisors shall furnish a report on the conduct of the student's work; the report shall not include an evaluation of the quality of the thesis.

DR11 Examination

a) The college academic affairs board shall appoint for each thesis three examiners, at least two of whom shall be responsible for external examination.

b)   Except with the permission of the college academic affairs board, at least one of the external examiners shall be based external to the country.
c)   A supervisor or co-supervisor shall not be appointed as an examiner.
d)   The names of the examiners shall not be known to either the candidate or to one another.

DR12 Defence of thesis

As part of the examination process, a student may be required to defend a thesis.

DR13 Re-examination of thesis

A failed thesis may not be re-examined.

Rules for Senior (Unsupervised) Doctoral Degrees

Note: The following Rule is additional to the preceding General Rules GR1 – GR33.

DS1 Applicability

a)   The following rules, DS2 to DS7 and DR 12 and DR13 inclusive shall also be applicable to every candidate for a senior (unsupervised) Doctoral degree.
b)   Additional rules governing the requirements for senior Doctoral degrees in particular colleges may be prescribed by the Senate and the Council.

DS2 Criteria for admission

a)   An applicant shall not be registered for the Senior (unsupervised) Doctoral degree through research unless the applicant:
     (i)   has a doctoral degree, and
     (ii)   is a graduate of this or another University of not less than 10 years standing.
b)   With the permission of the college academic affairs board, a candidate who does not meet the requirements in a) above may be admitted in terms of Rule GR7(b).
c)   A college may prescribe further minimum criteria for admission.

DS3 Period of registration

A candidate for the degree of Senior Doctoral must register for at least two semesters.

DS4 Subject of study

a)   A candidate for the senior (unsupervised) Doctoral degree shall submit for the approval of the college academic affairs board a summary in not more than 500 words, specifying the field of research covered by the published works and their appropriateness for the degree.

b) The senate may, at its discretion, decline to accept the published works if, in its opinion:
   (i) they are unsuitable in themselves, or
   (ii) the published work does not fall within the colleges of the University.

DS5 Submission of thesis

a) Every candidate for the senior (unsupervised) Doctoral degree through research shall be required to submit a thesis or a portfolio embodying a collection of published work, representing a significant contribution of knowledge and showing evidence of originality and clarity of thought, and of application of research methods appropriate to the particular field of study.

b) The published work submitted by a candidate may range over a number of different topics, but these should normally relate in a coherent way to a body of knowledge within a field recognized by the college. The amount of work submitted should be substantial, and concluded over a significant period of time having regard to the contribution to the discipline.

c) Candidates may not submit work previously submitted as a thesis for the Doctoral degree.

d) The college academic affairs board may appoint an appropriately qualified academic who is a member of the University staff, to advise the candidate on how to present the material for submission.

DS6 Format of thesis

a) Every thesis submitted shall include a declaration to the satisfaction of the Senate stating that it has not previously been submitted for a degree in this or any other university.

b) Every thesis submitted shall be in such format as prescribed by the Senate and the rules of the relevant college; provided that each thesis shall include an introduction in English linking the published work and explaining its significance and coherence.

c) Every thesis submitted shall include a signed statement indicating the level of contribution to each publication and role of the candidate as sole author, senior/principal author or co-author.

d) A thesis may comprise of published books and monographs, chapters in books, edited works, refereed conference proceedings, papers in peer-reviewed journals, accompanied by a comprehensive concluding integrative chapter.

DS7 Assessment

a) The Senate shall appoint for each thesis five persons to act as examiners, at least three of whom shall be responsible for external assessment.

b) Except with the permission of the Senate, at least two of the external examiners shall be based external to the country.

Rules for Certificates and Diplomas

Note: The following Rules are additional to the preceding General Rules GR1 – GR33.

CD1 Applicability

The following Rules, CD2 – CD3 inclusive, shall be applicable to every candidate for a Certificate and/or Diploma.

CD2 Admission

Applicants may be registered for a Certificate or Diploma provided that they have met the minimum criteria for admission to study as prescribed by the college.

CD3 Award of Certificate or Diploma with distinction

A qualification of Certificate or Diploma may be conferred with distinction in accordance with the rules of the relevant College, provided that, subject to exceptions as approved by the College Academic Affairs Board, the student has:

(i)   obtained a credit-weighted average of at least 75% over all modules required for the qualification; and

(ii)   successfully completed all modules in the curriculum without recourse to supplementary examinations; and

(iii)   completed the certificate or diploma in the prescribed minimum time.

COMMUNICATION PROTOCOL FOR ADDRESSING STUDENT GRIEVANCES

The following communication channels should be followed in addressing grievances, concerns or complaints (hereafter referred to as grievances) by students:

OFFICE OF THE OMBUD

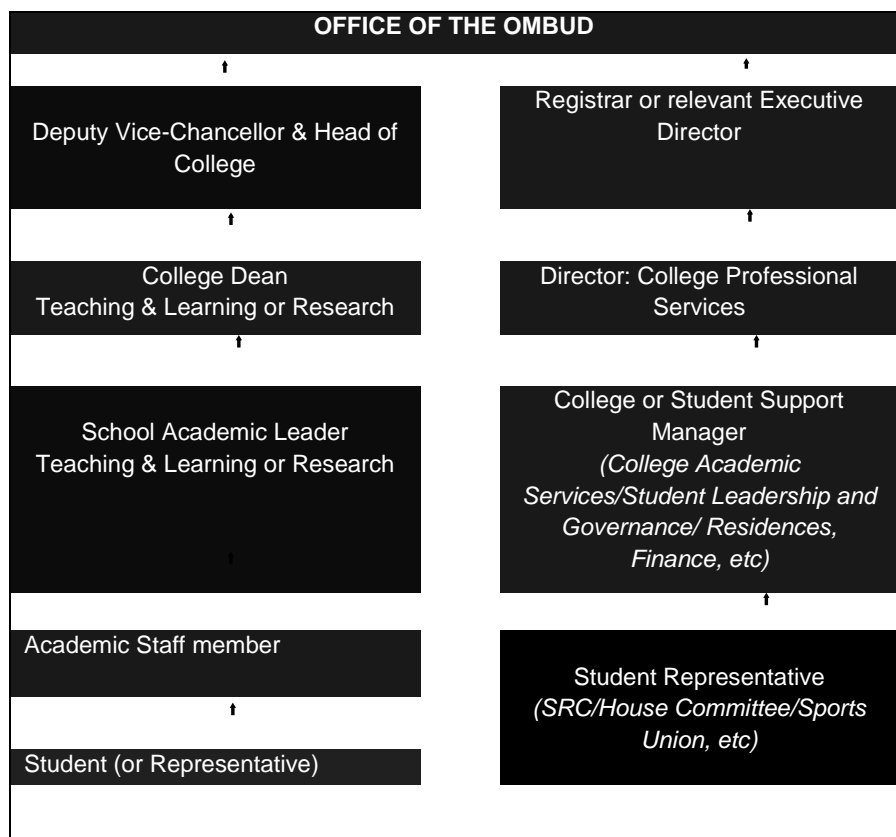| Deputy Vice-Chancellor & Head of College	Registrar or relevant Executive Director
College Dean Teaching & Learning or Research	Director: College Professional Services
School Academic Leader Teaching & Learning or Research	College or Student Support Manager *(College Academic Services/Student Leadership and Governance/ Residences, Finance, etc)*
Academic Staff member	Student Representative *(SRC/House Committee/Sports Union, etc)*
Student (or Representative)	

Figure 1

Academic matters include matters relating to lectures and lecturers, assessment, marks, plagiarism and cheating.

Non-academic matters include all other matter such as registration, financial queries such as fees and funding, residence matters … etc.

OUTLINE OF MEASURES TO BE TAKEN IN RESOLVING GRIEVANCES

1. Grievance in the first instance. Grievances should be clearly communicated in writing to the relevant Academic staff member or Support staff member (as illustrated in Figure 1) and where necessary, a formal meeting should be convened with the relevant responsible office at the onset of the grievances.

2. In the event that there has been no response or the grievances have not been resolved within 3 working days from the initial written communication or formal meeting respectively, follow-up measures telephonically, in writing and through a formal meeting, should be instituted using the proper chains of command as outlined in Figure 1.

3. In the event that the grievances are still not resolved through the follow-up communication and/or meeting, the grievances should be escalated to the higher level within the chain of command as outlined in Figure 1 until all avenues have been exhausted.

4. The Office of the Ombud serves as a point of last resort and will consider grievances when all formal University channels have been exhausted.

5. Once all avenues have been exhausted, proper protocols should be followed (as outlined in the Regulations for Staff and Student Gatherings, Demonstrations, Marches or Rallies) for embarking on a legal protest action.

6. All evidence relating to all attempts towards resolving grievances in the form of written communication and/or minutes of meetings which detail a record of decisions taken accompanied by a signed attendance register, should be properly documented and be made available by the aggrieved party(ies) upon request.

7. A summary of evidence of all attempts at resolving grievances documenting the dates, actions taken, the responsible individual(s) and the results of the actions taken should be made available, together with the supporting documentary evidence, by the responsible officer, upon request.

RULES FOR DEGREES AND DIPLOMAS IN THE COLLEGE OF AGRICULTURE, ENGINEERING AND SCIENCE

Note:
- **The General Academic Rules of the University shall, where applicable, also apply to the qualifications offered in the College.**
- **Students are advised that not all modules listed in this handbook will necessarily be offered and that the University reserves the right to withdraw modules at short notice if and when necessary.**
- **All first entry undergraduate students from 2014 must pass a module in isiZulu in order to be degree complete; or obtain exemption from the module under rule GR8a.**

Definition of Terms

College: The College of Agriculture, Engineering and Science (AES).

College Academic Affairs Board (CAAB): The College of Agriculture, Engineering and Science Academic Affairs Board.

Foundation Credits: Foundation credits are calculated on the basis of notional study hours in the same way as Degree Credits, and are a measure of the amount of formal 'Foundation' material in the curriculum. Foundation credits may not be used in lieu of Degree credits for the purpose of qualification for a degree in the College.

Module Level: Modules are designated as being Level 1 (first year), Level 2 (second year), Level 3 (third year), Level 4 (fourth year in Engineering), Level 7 (Honours or fourth year in Agriculture), Level 8 (Masters) and Level 9 (Doctoral). The Level of a module may be read from its module code (see the section "Introduction to Syllabuses"). It is given by the first numeric character in that code.

Year of Study: the level at which undergraduate students are registered academically.

(a) First year of study: applies to students who have not yet obtained at least 96 (degree) credits

(b) Second year of study:

    (i) in three-year programmes this applies to students who have obtained at least 96 (degree) credits, but have not yet registered for such modules as will, if passed, lead to the completion of the degree

    (ii) in four-year programmes this applies to students who have obtained at least 96 (degree) credits, but have not yet obtained 50% of the credits needed for the qualification.

(c) Third year of study:

(i)   in three-year programmes this applies to students who have registered for such modules as will, if passed, lead to the completion of the qualification.

(ii) in four-year programmes this applies to students who have obtained at least 50% of the credits needed for the qualification, but who have not yet registered for such modules as will, if passed, lead to the completion of the qualification.

(d) Fourth year of study: this applies to students in four-year programmes who have registered for such modules as will, if passed, lead to the completion of the qualification.

See also definitions in General Academic Rules

General Rules in College of Agriculture Engineering and Science

AES-G1 Degrees and Diplomas Awarded

Bachelor's Degrees	
Bachelor of Agricultural Management	BAgricMgmt
Bachelor of Agriculture in Agricultural Extension	BAgric
Bachelor of Science	BSc
Bachelor of Science in Agriculture	BScAgric
Bachelor of Science in Dietetics and Human Nutrition	BSDietHN
Bachelor of Science in Engineering	BScEng
Bachelor of Science in Land Surveying	BScSur
Post Graduate Diplomas	
Postgraduate Diploma in Food Security	PGDipFS
Honours Degrees	
Bachelor of Agriculture Honours	BAgricHons
Bachelor of Agricultural Management Honours	BAgricMgmtHons
Bachelor of Science Honours	BScHons
Bachelor of Science Property Development Honours in Construction Management	BScHons(CM)
Bachelor of Science in Property Development Honours in Quantity Surveying	BScHons(QS)
Master's Degrees	
Master of Agricultural Management	MAgricMgmt
Master of Agriculture	MAgric
Master of Science	MSc
Master of Science in Agriculture	MScAgric
Master of Science in Construction Management	MScConstMan
Master of Science in Dietetics	MScDiet
Master of Science in Engineering	MScEng
Master of Science in Human Nutrition	MScHumNutr
Master of Science in Engineering (Waste & Resources Management)	MSc-WR
Master of Science in Land Surveying	MScSur
Master of Science in Quantity Surveying	MSc-QS
Doctoral Degrees	
Doctor of Construction Management	DScConstMan

Doctor of Engineering	DScEng
Doctor of Land Surveying	DScSur
Doctor of Quantity Surveying	DScQS
Doctor of Philosophy	PhD
Doctor of Science	DSc
Doctor of Science in Agriculture	DScAgric

See also General Rule GR14Ancillary, prerequisite and corequisite requirements

AES-G2 Excluded Students

Students excluded by the College shall not be permitted to register for any module in the College, including modules taken for non-degree purposes, unless required by the programme for which they are now registered.

See also General Academic Rule GR31 Academic exclusion - right of appeal.

AES-G3 Supplementary Examinations

In addition to the University-wide rules on supplementary examinations, the following shall hold:

(a) A student who passes a module, shall be permitted to write a supplementary examination in that module in order to fulfil a sub-minimum pre-requisite requirement for another module.

(b) Certain modules, identified in the Syllabus Section, do not have supplementary examinations.

See also General Academic Rules GR22, BR6, HR5, PR5 and CR9.

ACCESS PROGRAMMES WITHIN THE COLLEGE OF AGRICULTURE, ENGINEERING AND SCIENCE

Augmented Programmes

The Augmented Programme allows students who would not normally qualify for entry into the College to complete the qualification in one more year than the normally allocated time.

In the *Augmented stream*, students are given extra tuition in the first two years, where they are separated from the mainstream lectures, tutorials and practicals. The content and expected outcomes of the augmented modules are the same as for the mainstream equivalent modules but in addition the augmented courses are supplemented by additional lectures, practical sessions and small group tutorials. Students cover the foundational material that may not have been covered in their school leaving qualification, which earns them foundation credits. Further instead of enrolling

for eight modules in first year, they will take only four, together with a module for Scientific Communication and another module for Life Skills.

BSc4 Augmented Stream
For admission criteria into the BSc4 Augmented Stream, see Rule AES-B2.

AES-B4A1 Structure of the Programme
For the first year of the Augmented programme all students take the same modules. From the second year the student's choice of modules must be approved by the School appropriate to their chosen major.

(a)   In their first year students will register for 64 foundation credits and 80 degree credits. The latter 64 credits must be from the augmented modules BIOL195, CHEM195, MATH195 and PHYS195 (each 16 degree credits).These are all year-long modules. Each of these modules will also carry 16 foundation credits so that the notional study hours for these modules will total 320.

(b)   In addition, students will register for both SCOM101 and SCOM 102 (single semester modules) in the first year of study. Each SCOM module carries 8 degree credits and no foundational credits.

(c)   Augmented students will also need to attend a module in LIfeSkills which carries no credit.

(d)   In their second year, students will normally register for between 64 and 80 degree credits. These will be selected from augmented (BIOL196, CHEM196, MATH196 and PHYS196) and regular Level-1 modules.

(e)   In their third year, students will normally register for 128 credits selected from Levels 2 and 3.

(f)   In their fourth year students will register for the credits required to complete their qualification.

(g)   Students are required to attend at least 80% of all timetabled Lifeskills workshops, lectures and presentations.

Note*: Augmented modules have separate codes (because their credit values and notional study hours are different). The table below shows the codes of the augmented modules and their mainstream equivalents.*

Augmented Module	Mainstream Module
BIOL195	BIOL101
BIOL196	BIOL102
CHEM195	CHEM110
CHEM196	CHEM120

MATH195	MATH130
MATH196	MATH140
PHYS195	PHYS110 or PHYS113
PHYS196	PHYS120 or PHYS114
MATH160	MATH131
MATH161	MATH141
ENME160	ENME1DR
ENCH160	ENCH1TC
ENAG161	ENME1EM
ENAG160	ENEL/EC/CE/CV/ME1ED
PHYS160	PHYS151
PHYS163	PHYS152

AES-B4A2 Completion of the Qualification

In order to satisfy the requirements for a three-year qualification within the College, students in the Augmented stream must complete 384 degree credits and between 64 and 96 foundation credits. The 384 degree credits must satisfy the requirements of Rule AES-BS1, AES-BAgM2, AES-BAg2, AES-BDiet3 or AES-BHN3, whichever is appropriate.

AES-B4A3 Transfers into Bachelor of Science in Agriculture

Students who transfer from the BSc4 into the BSc(Agric) must complete 512 degree credits and between 64 and 96 foundation credits. These 512 degree credits must satisfy the requirements of Rule AES-BScAg1.

AES-B4A4 Repeating of Modules

1. None of the augmented science modules BIOL195, BIOL 196, CHEM195, CHEM196, MATH195, MATH196, PHYS195, PHYS 196 may be repeated. Students who fail any of these and wish to obtain credit for these modules must register only for the corresponding non augmented, mainstream modules BIOL101, BIOL102, CHEM110,CHEM 120, MATH130, MATH 140, PHYS110, PHYS113 and PHYS120 or PHYS114.
2. SCOM101 and SCOM102 may be repeated no more than once.

Engineering Access Programme

The University of KwaZulu-Natal Engineering Access Programme provides an additional, alternative access route into the Bachelor of Science in Engineering, for prospective candidates who have had a disadvantaged educational background. Applications for admission to the Engineering Access

Programme must be made directly to the Central Applications Office. During the selection process, consideration is given to the academic record and personal circumstances of the applicant. Aptitude or other testing is frequently used, and the applicant may be required to attend an interview. Applicants for admission to the Engineering Access Programme may make funding applications directly to sponsoring companies, if financial support is required. It must be noted that the Engineering Access Programme has a very limited number of bursaries and financial aid packages which are awarded to the most deserving candidates.

AES-EA1 Admission Requirements
To be considered for admission to the Engineering Access Programme, applicants must have a National Senior Certificate for Degrees and must have obtained at least a level 4 (50%) for Mathematics, Physical Science and English as a Home Language or First Additional Language.

AES-EA2 Engineering Access Curriculum
Candidates shall obtain credit for the following modules in the course of one academic year. Numbers in brackets indicate the number of credits.

Year 1

Semester 1	Semester 2
MATH160 Augmented Engineering Mathematics 1A (16)	
PHYS160 Augmented Engineering Physics 1A (16)	
ENME160 Augmented Engineering Drawing* (8)	ENAG161 Augmented Engineering Materials* (8)
ENCH160 Augmented Technical Communication* (8)	ENAG160 Augmented Engineering Design 1* (8)
* 8 credit modules	

The student is thus required to enrol for 64 degree credits and 64 foundation credits in their first year.

Year 2

Semester 1	Semester 2
MATH161 Augmented Engineering Mathematics 1B	
PHYS163 Augmented Engineering Physics 1B	
MATH132 Applied Mathematics 1A	MATH142 Applied Mathematics 1B
CHEM181 Chemistry for Engineers 1A* 16 credits of level 2 programme specific modules	CHEM191 Chemistry for Engineers 1B* 16 credits Elective Module or Zulu 1

* 8 credit modules

  112 degree credits and 32 foundation credits

Year 3
Level 2 modules
128 degree credits

Year 4
Level 3 modules
128 degree credits

Year 5
Level 4 modules
144 degree credits

AES-EA3 Progression in the Engineering Access Programme
Augmented Engineering Progression Thresholds

No of Sem Completed	Min Progression Req	Normal Progression	75%
1	0	16	0
2	32	64	48
3	56	104	78
4	96	176	132
5	144	240	180
6	192	304	228
7	240	368	276
8	288	432	324
9	336	504	
10	384	576	
11	432		
12	480		
13	528		
14	576		

These thresholds are in accordance with the Academic Monitoring and Exclusions Policy.

Students in the Engineering Access programme shall be required to attend at least 80% of all timetabled Lifeskills workshops, lectures and presentations

BSc-4 (degree credits only): Augmented Progression Thresholds

No of Sem Completed	Max credits	Orange "at Risk" threshold	Red "underperforming" threshold (below min prog requirements)
1	-		16
2	32		48
3	96	80	80
4	160	128	112
5	224	168	144
6	272	208	192 (32 @ level 2)
7	320	240	224 (64 @ level 2)
8	384	288	256 (96 @ level 2 or 3)
9		336	288 (96 @ level 2 and 32 @ level 3)
10		384	320 (64 @ level 2)
11			352 (96 @ level 2)
12			384

Bachelor's Degrees

AES-B1 Admission to Bachelor's Degrees

Subject to additional requirements for specific degree programmes given in the table below, applicants shall be eligible to apply to register for undergraduate qualifications in the College provided they satisfy the University-wide entrance requirements and have a full National Senior Certificate for Degrees (NSC Deg).

Programme	NSC Points	Mathematics	Other Subjects
Bachelor of Agriculture	28	4 (50%)	Physical Science, Life Science or Agricultural Science 4 (50%)
BSc (LES Stream)	28	4 (50%)	Physical Science, Life Science or Agricultural Science 4 (50%)
BSc (M Stream)	30	5 (60%)	Physical Science, Life Science or Agricultural Science 4 (50%)
BSc Agriculture	28	4 (50%)	Physical Science, Life Science or Agricultural Science 4 (50%)
BSc Agriculture (Agricultural Economics)	28	4 (50%)	Physical Science, Life Science, Agricultural Science or Economics 4 (50%)
Bachelor of Agricultural Management	28	4 (50%)	Physical Science, Life Science, Agricultural Science or Economics 4 (50%)
BSc Dietetics and Human Nutrition	28	4 (50%)	Physical Science, Life Science or Agricultural Science 4 (50%)
BSc Engineering	33	6 (70%)	Physical Science 6 (70%) and either English as Home Language or as First Additional Language (4) 50%
BSc Land Surveying	33	6 (70%)	Physical Science 6 (70%) and either English as Home Language or as First Additional Language (4) 50%

Applicants who are accepted into one programme may apply to change to another programme only if they meet the entrance requirements of that programme.

All of the above is subject to the availability of places.

In all College entrance requirements Mathematics Literacy at any level will not act as a substitute for Mathematics.

AES-B2 Admission to the BSc4 (Augmented Stream)
(a)   Applicants who:
   (i)   Have a full NSC Deg with at least 26 points (excluding Life Orientation), and
   (ii) Have obtained a Level 3 (40%) in Mathematics and a Level 3 (40%) in Physical Science or
         Life Science or Agricultural Science, may apply to be registered for the BSc4 Augmented
         stream. This leads to the completion of a degree, usually in notless than four years.
(b)   Students who have attended the University or any tertiary institution, whether in a degree or
      access programme of any kind, for a complete semester, will not be admitted to the BSc4
      Augmented Stream.
(c)   Preference will be given to applicants who have had a disadvantaged School Background (as
      defined by Senate).

AES-B3 Transfers into Engineering and Land Surveying Degrees
In order to gain entry to Engineering, Land Surveying or Property Development from a BSc or
BSc-4 (Augmented), a credit weighted average of 65% and 65% for each of Mathematics,
Chemistry and Physics, and no failed modules, is required.

AES-B4 Applicants with Matric and Foreign Qualifications
(a) In order to establish whether they are eligible to apply, applicants with matric and foreign
qualifications: (A, A/S, O -levels, International Baccalaureate, HIGCSE and IGCSE) should use
the table below to obtain NSC equivalent point scores. The points score will be scaled to be
equivalent to 6 subjects if fewer subjects are used to gain Matric exemption.
(b) Applicants with other foreign qualifications will be considered on a case-by-case basis.
(c) Admission is subject to College and Universities South Africa (USAF)approval.

Admission to Bachelor's Degree Programmes

Points Equivalence for Selected Foreign Qualifications

Admission Points	HG	SG	A Level	AS Level	O Level	IB Higher	IB Standard	HIGCSE	IGCSE	NSC	NSC %
12			A			7					
11											
10			B			6					
9											
8	A		C	A		5		1		8	90-100
7	B		D	B		4	7	2		7	80-89
6	C	A	E	C		3	6	3		6	70-79
5	D	B		D	A		5	4	A	5	60-69
4	E	C		E	B		4		B	4	50-59
3	F	D			C				C	3	40-49
2		E								2	30-39
1		F								1	0-29
0											

AES-B5 Bachelors Degrees Registration

(a) The **normal load** is 64 credits per semester except in Engineering, Land Surveying and Property Development, where it is 72 credits per semester.

(b) In the first two semesters of registration, a student may register for no more than the normal load. Subsequent to the first two semesters of registration, a student who is in good academic standing (not "at risk" or "on probation" as defined in "Academic Monitoring and Exclusion") may register for up to 80 credits per semester. Students who are at risk or on probation may not register for more than a normal load.

(c) Students will not be allowed to register for two or more modules that have clashes in the time-table and will normally be required to register for the lower level of such clashing modules. If a timetable clash is identified after registration, the student will have to deregister the 'higher level' module in favour of the 'lower level' module.

(d) Subject to (b), students must register for all outstanding compulsory modules at the level of the lowest academic year that is not completed at the time of registration.

(e) Students registered for degrees in the College may not

(i) proceed to any Level-2 module until they have been previously registered for at least two semesters and have obtained at least 64 credits at Level 1 including at least 32 credits which are compulsory for the programme or major for which they are registered; nor

(ii) proceed to any Level-3 module until they have been previously registered for four semesters and have obtained at least 144 credits including 32 credits at Level 2 and have passed all Level-1 modules which are compulsory for the programme or majors for which they are registered.

(f) In exceptional circumstances and based on a full motivation, the Dean may relax the registration rules for a particular student.

AES-B6 Bachelors Degrees Progression

(a) The minimum College progression requirements referred to in the University Exclusions Policy are tabulated below.

No of semesters completed	BSc, BScAgric, BAgric, BScDiet, BAgricMgmt	BScEng BScSur BScPropDev	BSc4 Augmented stream (degree credits only)
1	32	48	-
2	64	96	32
3	96	144	64
4	144	192	112
5	176 (at least 16 at Level 2)	240	144
6	224 (at least 64 at Level 2)	288	192 (at least 32 at Level 2)
7	256 (at least 96 at Level 2 or 3)	336	224 (at least 64 at Level 2)
8	304 (at least 96 at Level 2 and 48 at Level 3)	384	256 (at least 96 at Level 2 or 3)
9	336 (at least 80 at Level 3)	432 (3-year qualification complete)	288 (at least 96 at Level 2 and 32 at Level 3)
10	384 (3-year qualification complete) (4-year qualification: at least 96 at Level 3)	480	320 (at least 64 at Level 3)
11	448 (at least 64 at Level 7)	528	352 (at least 96 at Level 3)
12	512 (4-year qualification complete)	576 (4-year qualification complete)	384 (3-year qualification complete) (4-year qualification: at least 96 at Level 3)
13			448 (4-year qualification: at least 64 at Level 7)
14			512 (4-year qualification complete)

(b)   Foundation credits are not included in these calculations.

(c)   For students who have transferred from other programmes, exempted credits and the corresponding period of study will be taken into account.

AES-B7 Bachelor Degrees Supplementary Examinations

In addition to the provisions of rules BR6 and AES-G3, students may apply to write a supplementary exam in a single module under one of the following conditions.

(a)   Students who can be registered within the normal load so as to be able to complete their degree in the current or next semester (provided they pass all modules), may be awarded a supplementary in a single module for which their mark is below 40%. The application to write this supplementary exam must be made to the College Office at least 2 working days before it is due to be written.

(b)   A student who was not at risk or on probation in the previous semester and who has a credit weighted average of at least 60%, may apply to write a supplementary in a single module for which their mark was below 40% in the main exam if this is in a subject in their lowest remaining year of study. This does not apply to students in their first semester.

AES-B8 Minor Substitutions in Curriculum

The relevant School Board may permit minor substitutions in the modules prescribed for any Bachelor's degree.

Degree of Bachelor of Science

AES-BS1 Structure of the Degree

The following applies to degrees based on majors (see Rule AES-BS4) and on Focussed Programmes (see Rule AES-BS5):

(a)　　　the minimum duration for the qualification is 6 semesters;

(b)　　　the qualification requires that a set of modules with a total credit value of at least 384 be passed, subject to the following conditions:

　　　(i)　at least 128 credits shall be at Level 3;

　　　(ii)　at least 96 credits shall be at Level 2;

　　　(iii)　at least 96 credits shall be at Level 1; and

　　　(iv)　the unspecified credits may include elective modules with a combined credit value not exceeding 32, offered in any other College within the University, subject to approval of the Dean and Head of School offering the module. These external credits shall be counted at Level 1.

(c)　　In order to complete the qualification, students registered for the first time from 2014 must pass or obtain credit for ZULN101, unless otherwise exempted in terms of Rule GR8.

AES-BS2 Common Curriculum

All students enrolled in any Bachelor of Science programme must follow a common curriculum in the first semester of their first year. This is further divided into two broad groupings:

- *Life and Earth Sciences* (LES) stream, which encompasses programmes and majors within the Life Sciences, Geology, Geography and Environmental Sciences; and
- *Mathematical Sciences* (M) stream, which encompasses programmes and majors within the disciplines of Computer Science, Mathematics, Physics and Statistics.

Chemistry can fit into either grouping depending on the choice of a second major.

The modules for the first semester are as follows:

LES stream

CHEM110	16 credits
MATH130 or MATH150	16 credits

and two further modules selected from

BIOL101	16 credits
PHYS131 or PHYS110 or PHYS113	16 credits
GEOL101	16 credits
(not offered in Pietermaritzburg)	
GEOG110	16 credits

M stream

MATH130	16 credits

and three further modules selected from

CHEM110	16 credits
COMP100	16 credits
ECON101	16 credits
PHYS110 or PHYS114	16 credits
STAT130	16 credits

Notes:

(i)   *In majors and programmes in the LES stream MATH150 may be replaced by MATH130. Moreover PHYS131 may be replaced by PHYS110 or PHYS113. Some programmes may require one or both of these replacements.*

(ii)   *Other combinations of electives may be permitted at the discretion of the School.*

AES-BS3 Structure of the Degree based on Majors

In addition to Rules AES-BS1 andAES-BS2, the following applies to degrees based on majors:

(a)   no more than 64 credits may be specified at Level-2, of which at least 32 and no more than 48 shall be in modules specified for a primary major subject (from List A below); the balance of the Level-2 modules may be from subjects given in Lists A, B or C.

(b)   at least 64 and no more than 80 credits at Level-3 shall be in modules specified for primary major subject from List A below, with the balance from modules in other subjects given in Lists A, B or C;

(c)   except as provided for in (d) below, all Level-1 and Level-2 modules shall come from disciplines in Lists A or B, or modules mentioned in List C;

(d)   the unspecified credits points may, subject to the approval of the Dean and Head of School, contain elective modules with a combined credit value not exceeding 32, offered in any college (these external credits shall be counted at Level-1); and

(e)   students may major in more than one discipline. In that case, no more than 16 credits at exit level may be counted towards both majors.

(f)   Credit will not be given for modules, offered in another College, whose content is broadly contained within modules offered by the College.

List A (primary major subjects):

Applied Mathematics	Geography
Astronomy	Hydrology
Biochemistry	Mathematics

Biology	Microbiology
Cellular Biology	Physics
Chemistry	Plant Pathology
Computer Science	Soil Science
Data Science	Statistics
Ecology	Genetics

List B (other major subjects):
- Economics
- Psychology (Pietermaritzburg only).

List C (other recognised modules):
- any module specified for a particular programme in which the student is registered;
- Any module in a subject offered in the College, for which the pre-requisites have been met.

AES-BS4 Rules of Combination for Majors

The tables below give the modules needed to major in a particular discipline. Numbers in parentheses denote the number of credits for a module. The remaining credits (to ensure that Rule AES-BS1 is satisfied) must be drawn from other modules in accord with Rules AES-BS2 and AES-BS3.

The modules listed in first year are for first-year students, those for second year are for second-year students and so on. Students in first year should not assume that the modules listed below will be the same by the time they reach second and higher years.

Please note that electives in the first Semester of first year must accord with Rule AESBS2. Students may be required to register for focussed programmes if their combinations of major disciplines are available within a focussed programme.

1. Applied Mathematics (Pietermaritzburg, Westville)

Year 1	MATH130(16), 140(16)
Year 2	MATH212(16), 251(16)
Year 3	Pietermaritzburg: MATH327(16), 356(16), 334(16), 16C from (MATH301(16), 310(16), 331(16), 340(16), 342(16))
	Westville: MATH334(16), 356(16), 32C from (MATH301(16), 310(16), 327(16), 338(16), 340(16), 342(16), 344(16), 347(16)

2. Applied Physics (Westville)

Year 1	MATH130(16), 140(16), PHYS110/113(16), 120/114(16), Electives (64)
Year 2	PHYS213(16), 231(16), 214(16), 242(16), Electives (64)

Year 3	PHYS313(16), 363(16), 343(16), 314(16); 315(16), 345(16), Electives (32)

3. Astronomy (Westville)

Year 1	MATH130(16), 140(16), PHYS113(16), 114(16)
Year 2	ASTR203(16), 204(16), MATH212(16), 251(16)
Year 3	ASTR301(16), ASTR304(16), ASTR303(16), 16C from (MATH327(16), MATH344(16))

4. Biochemistry (Pietermaritzburg, Westville)

Year 1	BIOL101(16), CHEM110(16), 120(16), MATH150(16), PHYS131(16), STAT130(16)
Year 2	Pietermaritzburg: BIOC201(16), 212(16), CHEM220(16), RDNA202(16)
	Westville: BIOC201(16), 202(16), CHEM220(16), RDNA202(16)
Year 3	Pietermaritzburg: BIOC300(16), 311(16), 315(16), 316(16)
	Westville: BIOC307(16), 308(16), 315(16), 316(16)

5. Biology (Pietermaritzburg)

Year 1	BIOL101(16), 102(16), CHEM110(16), CHEM120(16), MATH150(16), PHYS131(16), STAT130(16)
Year 2	BIOL211(16), 213(16), 16C from (BIOL204(16), 222(16)), RDNA202(16)
Year 3	BIOL304(16), 305(16), 315(16), 324(16)

6. Cellular Biology (Westville)

Year 1	BIOL101(16), 102(16), CHEM110(16), CHEM120(16), MATH150(16), PHYS131(16), STAT130(16)
Year 2	(BIOC201(16) or BIOC203(16)), 234(16), RDNA202(16)
Year 3	BIOL316(16), 345(16), 350(16), (BIOL304(16) or 347(16) OR 344(16))

7. Chemistry (Pietermaritzburg, Westville)

Year 1	Pietermaritzburg: CHEM110(16), 120(16), MATH130(16) or 150(16), MATH140(16) or 143(8), PHYS113(16) or 131(16), PHYS120(16) or 133(8)
	Westville: CHEM110(16), 120(16), MATH130(16) or 150(16), MATH140(16) or 145(16), PHYS110/113(16) or 131(16), PHYS120/114(16) or 132(16).
Year 2	CHEM210(16), 220(16), 230(16)
Year 3	CHEM310(16), 320(16), 330(16), 340(16)

8. Computer Science (Pietermaritzburg, Westville)

Year 1	COMP100(16), 102(16), 107(16), MATH130(16), 140(16)
Year 2	COMP200(16), 201(16), 16C from MATH at Level 2
Year 3	Pietermaritzburg: COMP304(16), 313(16), 314(16), 315(16)
	Westville: COMP314(16), 315(16), 32C from (COMP300(16), 301(16), 304(16), 306(16), 307(16), 313(16))

9. Computer Science and Statistics (Data Science Stream) (Pietermaritzburg, Westville)

Year 1	
Semester 1	COMP100 (16), MATH130(16), STAT130(16), Elective(16)
Semester 2	COMP102(16), MATH140(16), STAT140(16), Elective(16)
Year 2	
Semester 1	COMP200 (16), STAT230(16), MATH212(16), MATH236
Semester 2	COMP201(16), STAT240(16), MATH251(16), Elective(16)
Year 3	
Semester 1	COMP315 (16), COMP313(16), STAT301(16), STAT395(16)
Semester 2	COMP314(16), COMP304(16), STAT305(16), STAT350(16)

10. Ecology (Pietermaritzburg)

Year 1	BIOL101(16), 102(16), CHEM110(16), CHEM120(16), MATH150(16), PHYS131(16), STAT130(16)
Year 2	BIOL204(16), 223(16), (BIOL211(16) or 222(16))
Year 3	BIOL322(16), 323(16), 325(16), 16C from (BIOL304(16), BIOL305(16), BIOL390(16))

11. Economics (Pietermaritzburg, Westville)

Year 1	ECON101(16), 102(16), MATH130(16), 140(16)
Year 2	ECON201(16), 202(16)
Year 3	ECON314(16), 48C from ECON as specified by the School of Accounting Economics & Finance.

Notes:
(i) *Economics can only be taken in conjunction with another primary major.*
(ii) *Students majoring in Statistics cannot take ECON314, and must replace that module with ECON309.*

12. Genetics (Pietermaritzburg, Westville)

Year 1	BIOL101(16), BIOL102(16), CHEM110(16), 120(16), MATH150(16), PHYS131(16), STAT130(16)
Year 2	GENE240(16), RDNA202(16), STAT222(16) or BIOL200(16)
Year 3	Pietermaritzburg: GENE310(16), 320(16), 330(16), 16C from (AGPS306(16), BIOL304(16), GENE350(16))
	Westville: GENE310(16), 320(16), 330(16), 16C from (BIOL304(16), GENE340(16))

13. Geography (Pietermaritzburg, Westville)

Year 1	CHEM110(16), ENVS120(16), GEOG110(16), MATH150(16), STAT130(16)
Year 2	ENVS210(16), 211(16), GEOG220(16)
Year 3	Westville: 64Cr from (ENVS322(16),314(16), 315(16), 316(16), 390(16); GEOG330(16))

	Pietermaritzburg: 64Cr from (ENVS322(16), 314(16), 315(16). 316(16), 319(16); (GEOG301(16), 320(16) or 330(16))

14. Hydrology (Pietermaritzburg)

Year 1	CHEM110(16), MATH150(16), PHYS110(16) or 131(16)
Year 2	HYDR210(16), HYDR220(16)
Year 3	HYDR310(16), AGPS301(16), HYDR322(8), HYDR330(8), HYDR324(16)

15. Mathematics (Pietermaritzburg, Westville)

Year 1	MATH130(16), 140(16)
Year 2	MATH212(16), 251(16)
Year 3	Pietermaritzburg: MATH310(16), 340(16), 356(16), 16c from (MATH342(16), 301(16), 327(16) or 334(16))
	Westville: MATH310(16), 340(16), 356(16), 16C from (MATH301(16), 327(16), 334(16), 338(16), 342(16), 344(16), 347(16))

16. Microbiology (Pietermaritzburg, Westville)

Year 1	BIOL101(16), STAT130(16) CHEM110(16), 120(16), MATH150(16), PHYS131(16)
Year 2	Pietermaritzburg: (BIOC201(16) or CHEM220(16)), MICR213(16), 214(8), RDNA202(16)
	Westville: MICR213(16), 215(16), RDNA202(16)
Year 3	Pietermaritzburg: MICR304(16), 307(16), 320(16), 360(16)
	Westville: MICR304(16), 306(16), 307(16), 311(16)

17. Physics (Pietermaritzburg, Westville)

Year 1	Pietermaritzburg: MATH130(16), 140(16), PHYS110(16), 120(16)
	Westville: MATH130(16); 140(16); PHYS113(16), 114(16)
Year 2	Pietermaritzburg: PHYS211(16), 212(16), 263(16)
	Westville: MATH212(16), 251(16), PHYS213(16), 214(16)
Year 3	Pietermaritzburg: PHYS361(16), 365(16), 367(16), 368(16)
	Westville: PHYS313(16), 314(16), 315(16), 363(16)

18. Plant Pathology (Pietermaritzburg)

Year 1	BIOL101(16), CHEM110(16), 120(16), MATH150(16), PHYS131(16)
Year 2	PPTH214(16), RDNA202(16)
Year 3	PPTH305(16), 330(16), 360(16), 370(16)

19. Psychology (Pietermaritzburg)

Year 1	CHEM110(16), MATH150(16), PSYC101(16), 102(16)
Year 2	PSYC201(16), 16C from PSYC

Year 3	PSYC301(16), 48C from Level 3 PSYC

Notes:

(i)   Psychology can only be taken in conjunction with another primary major.

(ii)   The above rules of combination refer only to Psychology taken as a major within the College.

20. Soil Science (Pietermaritzburg)

Year 1	CHEM110(16), 120(16), ENVS120(16), (MATH130(16) or 150(16)), (PHYS131(16) or 110(16))
Year 2	SSCI217(16), 230(16), 260(16)
Year 3	AGPS301(16), SSCI320(16), 353(16), 373(16)

21. Statistics (Pietermaritzburg, Westville)

Year 1	MATH130(16), 140(16), STAT130(16), 140(16)
Year 2	MATH212(16), 251(16), STAT230(16), 240(16); 243(16)
Year 3	Pietermaritzburg: STAT301(16), 305(16), 350(16), 395(16)
	Westville: STAT301(16), 305(16), 350(16), 395(16)

AES-BS5 Focussed Programmes

The tables below give the programmes of study for focussed programmes within the degree of Bachelor of Science. All modules must be chosen in accordance with Rules AES-BS1 to AESBS3 and require approval by the Dean and Head of School. Numbers in brackets denote the number of credits for a module.

Please note that this Handbook contains only modules to be taught in 2019 The modules listed in first year are for first-year students, those for second year are for second-year students and so on. Students in first year should not assume that the modules listed below will be the same by the time they reach second and higher years.

1. Applied Chemistry (Westville)

Year 1	
Semester 1	CHEM110(16), MATH130 or 150(16), PHYS110/113(16) or 131(16), Elective(16)
Semester 2	CHEM120(16), MATH140(16) or 145(16), PHYS120/114(16) or 132(16), Elective(16)
Year 2	
Semester 1	APCH221(16), CHEM210(16), 220(16), STAT130(16)
Semester 2	APCH211(16), 231(16), CHEM230(16), ZULN101(16) or Elective (16)
Year 3	
Semester 1	APCH312(16), 322(16), CHEM330(16), 340(16)
Semester 2	APCH332(16), 342(16), CHEM310(16), 320(16)

Notes:
(i)   *Entrance into the Applied Chemistry Programme is limited and will be based on merit.*
(ii)   *STAT130 may be taken in either the first or the second year.*

2. Biological Sciences (General Stream) (Pietermaritzburg, Westville)

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	BIOL102(16), CHEM120(16); STAT130(16), Elective(16)
Year 2	
	BIOL200(16), 204(16), GENE240(16), RDNA202(16), 32C from Level-2 BIOL modules as directed by the School, Electives(32)
Year3	
	BIOL300(16), 304(16), 390(16), 32C from (BIOL321(16), 324(16), 347(16), 348(16)), 48C from Level-3 BIOL modules or alternatives approved by the School.

3. Chemistry & Chemical Technology (Pietermaritzburg

Year 1	
Semester 1	CHEM110(16), MATH130(16) or 150(16), PHYS110(16) or 131(16), Elective(16)
Semester 2	CHEM120(16), MATH140(16) or 143(8), PHYS120(16) or 133(8), STAT130(16), Electives to make up 64 credits
Year 2	
Semester 1	CHEM210(16), 220(16), Electives(32)
Semester 2	CHEM230(16), CTEC233(16), Electives(32)
Year 3	
Semester 1	CHEM330(16), 340(16), CTEC323(16), 333(16)
Semester 2	CHEM310(16), 320(16), CTEC313(16), 343(16)

4.(a) Computer Science & Information Technology (Computer Science Stream) (Westville)

Year 1	
Semester 1	COMP100(16), MATH130(16), STAT130(16), Elective(16)
Semester 2	COMP102(16), 107(16), MATH140(16), Elective(16)
Year 2	
Semester 1	COMP200(16), MATH236(16), 16C from (MATH212(16), 235(16), STAT230(16)), Electives(16)
Semester 2	COMP201(16), 204(16), 16C from (MATH243(16), 246(16), 251(16), STAT240(16)), Elective(16)
Year 3	
Semester 1	COMP313(16), 315(16), 16C at level 3 from COMP, 16C at level 3 from COMP, MATH or STAT
Semester 2	COMP301(16), 304(16), 314(16), 16C at level 3 from COMP, MATH or STAT

4.(b) Computer Science & Information Technology (Information Technology Stream) (Pietermaritzburg, Westville)

Year 1	
Semester 1	COMP100(16), MATH130(16), STAT130(16), Elective(16)
Semester 2	COMP102(16), 107(16), MATH140(16), Elective(16)
Year 2	
Semester 1	COMP200(16), ISTN211(16), MATH236(16), Elective(16)
Semester 2	Pietermaritzburg: COMP201(16), 203(16), ISTN212(16), Elective(16)
	Westville: COMP201(16), 204(16), ISTN212(16), Elective(16)
Year 3	
Semester 1	COMP313(16), 315(16), ISTN3AS(16), ISTN3SA(16)

Semester 2	COMP304(16), 314(16), ISTN3SI(16), ISTN3ND(16)

5. Crop & Horticultural Science (Pietermaritzburg)

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	BIOL102(16), CHEM120(16), MATH143(8), PHYS133(8), STAT130(16)
Year 2	
Semester 1	AMET210(16), GENE240(16), SSCI217(16), (BIOL204(16) or ZULN101 or Elective(16))
Semester 2	AGPS200(16), BIOC212(16), PPTH214(16), STAT222(16)
Year 3	
Semester 1	64C from (AGPS301(16), 305(16), 307(16), 309(16), 311(16))
Semester 2	AGPS308(16), 320(16), SSCI320(16), Level-3 Elective (16)

6. Environmental Earth Science (Pietermaritzburg)

Year 1	
Semester 1	BIOL101(16) or GEOL101(16)), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	(BIOL102(16) or GEOL102(16)), COMP106(16), ENVS120(16), STAT130(16)
Year 2	
Semester 1	AMET210(16), ENVS210(16), HYDR210(16), SSCI217(16)
Semester 2	ENVS211(16), (AMET212(16) or SSCI230(16)), (HYDR220(16) or SSCI260(16)), (ZULN101(16) or Elective(16))
Year 3	
Semester 1	ENVS315(16), 316(16); HYDR Stream: HYDR310(16) and AGPS301(16) SSCI Stream: SSCI353(16) and AGPS301(16) ENVE Stream: HYDR310(16) and SSCI353(16)
Semester 2	ENVS322(16), ENVS319(16), (HYDR322(8) and HYDR324(16) and HYDR330(8)) or (SSCI320(16) and SSCI373(16))

Note:
Students on the Westville campus will have to transfer to Pietermaritzburg after Year 1.

7.(a) Environmental Science (Pietermaritzburg, Westville)

Year 1	
Semester 1	BIOL101(16), CHEM110(16), GEOG110(16), MATH150(16)
Semester 2	BIOL102(16), ENVS120(16), STAT130(16), 16C from ZULU101(16) or Elective (16)
Year 2	
Semester 1	ENVS210(16), BIOL200(16), 32C from (BIOL204(16), 212(16), 213(16), 214(16), 223(16), SSCI217(16))

Semester 2	ENVS211(16), GEOG220(16), BIOL222(16) or 231(16), 16C from BIOL211(16), ZULN101(16) or Elective (16)
Year 3	
	For PMB: BIOL305(16), ENVS314(16), ENV315(16), ENVS316(16),, ENVS319(16), ENVS322(16), 32 credits from BIOL For Westville: BIOL305(16), ENVS314(16), ENV315(16), ENVS316(16), ENVS390(16), ENVS322(16), 32 credits from BIOL

Note:
Entry to ENVS315 will be restricted to students in the Environmental Sciences Programme.
Students will need to check with the Academic Coordinators for Geography on Pietermaritzburg and Westville to confirm in which semester the ENVS modules will be offered.

7.(b) Environmental Science (Grassland Science Stream) (Pietermaritzburg)

This programme is not offered this year.

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), Elective (16)
Semester 2	BIOL102(16), ENVS120(16), STAT130(16), (Elective(16) or ZULN101(16))
Year 2	
Semester 1	BIOL200(16), 223(16), SSCI217(16), 16C from (AMET210(16); or ENVS210(16))
Semester 2	AGPS230(16); AGPS200(16); BIOL211(16); ENVS211(16)
Year 3	
Semester 1	AGPS301(16); AGPS305(16); BIOL323(16); ENVS316(16)
Semester 2	AGPS308(16); ENVS322(16); BIOL390(16), Level-3 Elective(16)

8.(a) Geological Sciences (Environmental and Engineering Geology Stream) (Westville)

Year 1	
Semester 1	CHEM110(16), GEOL101(16), MATH150(16), 16C from GEOG110(16) or BIOL101(16)
Semester 2	CHEM120(16), COMP106(16), GEOL102(16), 16C from ENVS120(16) or BIOL102 (16)
Year 2	
Semester 1	GEOL201(8), 202(8), 205(8), 220(8), Electives(32)
Vacation	GEOL200(16)
Semester 2	ENVS211(16), GEOL211(8), 206(16) Elective(8)

Year 3	
Semester 1	GEOL313(16), 314(16), 306(8), ENVS316(16), Level-3 Elective(8)
Vacation	GEOL304(16)
Semester 2	GEOL321(16), 323(8), Level-3 Electives(24)

8.(b) Geological Sciences (Geology and Ore Deposits Stream) (Westville)

Year 1	
Semester 1	CHEM110(16), GEOL101(16), MATH150(16), GEOG110(16) or BIOL101(16)
Semester 2	CHEM120(16), COMP106(16), GEOL102(16), ENVS120(16) or BIOL102(16)
Year 2	
Semester 1	GEOL201(8), 202(8), 205(8), 220(8), Electives(32)
Vacation	GEOL200(16)
Semester 2	ENVS211(16), GEOL206(16), GEOL211(8), Elective(8)
Year 3	
Semester 1	GEOL301(16), 303(8), 306(8), ENVS316(16), Level-3 Electives(16)
Vacation	GEOL304(16)
Semester 2	GEOL308(16), 310(8), 323(8), Level-3 Electives(16)

Notes:
(i) *Entry into GEOL200, GEOL202, GEOL205 and GEOL206 will be restricted to students in the Geological Sciences programme and limited to a maximum of 56 students. Selection for these modules will be on academic merit and the decision on whether a student will be admitted will only be taken after s/he has passed all of GEOL101, GEOL102, CHEM110, CHEM120, and either MATH130 or MATH150.*
(ii) *Students will only be allowed to register for GEOL200, GEOL202, GEOL205 and GEOL206 a maximum of 3 times, after which they will be required to de-register from the Geological Sciences programme.*

9. Industrial and Applied Biotechnology (Pietermaritzburg)

Year 1	
Semester 1	BIOL101(16), CHEM110(16), (MATH130(16) or 150(16)), PHYS110(16) or 131(16)
Semester 2	STAT130(16), CHEM120(16), MATH143(8), PHYS133(8), Elective(16)
Year 2	
Semester 1	BIOC201(16), CHEM220(16), (CHEM210(16) or GENE240(16)), MICR213(16)
Semester 2	(BIOC212(16) or (MICR214(8) and MICR220(8)), CHEM230(16), CTEC233(16), RDNA202(16)
Year 3	
Semester 1	BIOC311(16), CHEM330(16), CTEC333(16), MICR320(16)

| Semester 2 | CTEC343(16), MICR304(16), 360(16), 16C from (BIOC300(16), CHEM320(16), GENE330(16)) |

10. Marine Biology (Westville)

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	BIOL102(16), CHEM120(16), STAT130(16), Elective(16)
Year2	
Semester 1	BIOL200(16), 204(16), 214(16), Elective(16)
Semester 2	BIOL210(16), 231(16); ENVS211(16); RDNA202(16)
Year 3	
Semester 1	BIOL305(16), 310(16), 341(16), ENVS316(16)
Semester 2	BIOL304(16), 342(16), 343(16), 391(16)

Degree of Bachelor of Science in Agriculture

AES-BScAg1 Structure of the Degree
(a)   The minimum duration for the qualification is 8 semesters.
(b)   The qualification requires that a set of modules with a total credit value of at least 512 be passed, subject to the following conditions:
    (i)   at least 96 credits shall be at each of Levels 1, 2, 3 and 7;
    (ii) a maximum of 160 credits shall be at Level 1;
    (iii) total of at least 224 credits shall be at Levels 2 and 3;
    (iv) a total of at least 224 credits shall be at Levels 3 and 7;
(c)   Students may not proceed to any Level-7 module until they have obtained a total of at least 128 credits from Levels 2 and 3 including at least 64 credits at Level 3.
(d)   Students will elect to undertake one of the programmes listed in Rule AES-BScAg2, where the modules required for the programme of study are given. All elective modules must be chosen in accordance with Rule AES-BScAg1(b) and require approval by the Dean and Head of School.
(e)   In order to complete the qualification, students registered for the first time from 2014 must pass or obtain credit for ZULN101, unless otherwise exempted in terms of Rule GR8.

AES-BScAg2 Programmes of Studies
The following tables give the programmes of study within the degree.

1.(a) Agribusiness (Animal Science Stream)

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	BIOL102(16), CHEM120(16), MATH143(8), PHYS133(8), STAT130(16)
Year 2	
Semester 1	AGEC210(16), 220(16), BIOC201(16), STAT221(16)
Semester 2	AGEC270(16), ANSI201(16), 209(16), (ZULN101(16) or Elective(16))
Year 3	
Semester 1	AGEC380(16), ANSI312(16), 333(16), 352(16)
Semester 2	AGEC370(16), ANSI311(16), 370(16), Level-3 Elective(16)
Year 4	
Semester 1	AGEC750(16), ANSI711(16), Level-7 Elective(16)
Semester 2	AGEC740(16), ANSI712(16), Level-7 Elective(16)
Year Modules	AGBU791(32)

1.(b) Agribusiness (Crop & Horticultural Science Stream)

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	BIOL102(16), CHEM120(16), MATH143(8), PHYS133(8), STAT130(16)
Year 2	
Semester 1	AGEC210(16), 220(16), STAT221(16), Elective(16)
Semester 2	AGEC270(16), AGPS200(16), (ZULN101(16) or Elective(16)), Elective(16)
Year 3	
Semester 1	AGEC380(16), AGPS301(16), (AGPS305(16) or 309(16)), AGPS307(16)
Semester 2	AGEC370(16), AGPS308(16), Electives(32)
Year 4	
Semester 1	AGEC750(16), AGPS701(8), 32C from (AGPS710(16), 715(16), 716(16), 733(16))
Semester 2	AGEC740(16), AGPS791(8), 16C from (AGPS712(16), 714(16), 732(16), 734(16))
Year Modules	AGBU791(32)

1.(c) Agribusiness (Wildlife Management Science Stream)

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	BIOL102(16), CHEM120(16), MATH143(8), PHYS133(8), STAT130(16)
Year 2	
Semester 1	AGEC210(16), 220(16), BIOL223(16), STAT221(16)
Semester 2	AGEC270(16), BIOL222(16), ENVS211(16), (ZULN101(16) or Elective(16))
Year 3	
Semester 1	AGEC380(16), BIOL305(16), 323(16), ENVS316(16)
Semester 2	AGEC370(16), ENVS322(16), Level-3 Electives(32)
Year 4	
Semester 1	AGEC750(16), BIOL701(16), 722(16), 723(16)
Semester 2	AGEC740(16), Level-7 Elective(16)
Year Modules	AGBU791(32)

2. Agricultural Economics

Year 1	
Semester 1	BIOL101(16), ECON101(16), ISTN101(16), MATH150(16)
Semester 2	BIOL102(16), ECON102(16), (ISTN103(16) or ZULN101(16)), STAT130(16)
Year 2	
Semester 1	AGEC220(16), ECON201(16), ACCT101(16), STAT221(16)

Semester 2	ACCT103(16), AGEC270(16), ECON202(16), 16C from ((AGPS200(16), ANSI201(16), 209(16))
Year 3	
Semester 1	AGEC380(16), ECON306(16), 32C from ((AGPS305(16), 307(16), 309(16); ECON315(16))
Semester 2	AGEC370(16), ECON314(16), 309(16), 16C from ECON370(16) or any other level 3 Elective (16) in consultation with the discipline. In order to meet the requirements for the degree, students must pass either ECON315 OR ECON370
Year 4	
Semester 1	AGEC750(16), BMET314(8), 316(8), Level-7 Elective(16)
Semester 2	AGEC740(16), Level-7 Electives(32)
Year Modules	AGEC791(32)

3.(a) Agricultural Plant Sciences (Crop Science Stream)

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	BIOL102(16), CHEM120(16), MATH143(8), PHYS133(8), STAT130(16)
Year 2	
Semester 1	AGEC210(16), GENE240(16), SSCI217(16), (AMET210(16) or ZULN101(16))
Semester 2	AGPS200(16), BIOC212(16), (PPTH214(16) or SSCI230(16)), STAT222(16)
Year 3	
Semester 1	AGPS301(16), 305(16), 32C from (AGPS307(16), 309(16), 311(16))
Semester 2	AGPS308(16), 320(16), SSCI320(16), Level-3 Elective (16)
Year 4	
Semester 1	AGPS701(8), 710(16), 715(16), Electives at Levels 3 or 7 (16) in either semester
Semester 2	AGPS712(16), 714(16), 791(8)
Year Modules	AGPS790(32)

3.(b) Agricultural Plant Sciences (Horticultural Science Stream)

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	BIOL102(16), CHEM120(16), MATH143(8), PHYS133(8), STAT130(16)
Year 2	
Semester 1	AGEC210(16), GENE240(16), SSCI217(16), (AMET210(16) or ZULN101(16))
Semester 2	AGPS200(16), BIOC212(16), (PPTH214 (16) or SSCI230(16), STAT222(16)
Year 3	
Semester 1	AGPS301(16), (AGPS305(16) or 311(16)), 307(16), 309(16)
Semester 2	AGPS308(16), 320(16), SSCI320(16), Level-3 Elective (16)
Year 4	

Semester 1	AGPS701(8), 716(16), 733(16)	Electives (16)
Semester 2	AGPS 732(16), 734(16), 791(8)	
Year Modules	AGPS790(32)	

3.(c) Agricultural Plant Sciences (Plant Breeding Stream)

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	BIOL102(16), CHEM120(16), MATH143(8), PHYS133(8), STAT130(16)
Year 2	
Semester 1	AGEC210(16), GENE240(16), SSCI217(16), (AMET210(16) or ZULN101(16))
Semester 2	AGPS200(16), BIOC212(16), PPTH214(16), STAT222(16),
Year 3	
Semester 1	AGPS305(16), (AGPS307(16) or 309(16)), AGPS311(16), GENE310(16)
Semester 2	AGPS306(16), 308(16), 320(16), SSCI320(16)
Year 4	
Semester 1	AGPS701(8), 733(16), GENE715(16), PPTH330(16), Elective(8)
Semester 2	(AGPS712(16) or 714(16)), AGPS730(16)
Year Modules	AGPS790(32)

3.(d) Agricultural Plant Sciences (Grassland Science Stream)
This programme is not offered this year.

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	BIOL102(16), CHEM120(16), MATH143(8), PHYS133(8), STAT130(16)
Year 2	
Semester 1	AGEC210(16); BIOL223(16); SSCI217(16); (AMET210(16) or ENVS210(16))
Semester 2	AGPS230(16); AGPS200(16); STAT222(16); (AMET212(16) or ZULN101(16))
Year 3	
Semester 1	AGPS301(16); AGPS305(16); BIOL323(16); GENE240(16)
Semester 2	ENVS211(16); AGPS308(16); ENVS322(16); ANSI312(16)
Year 4	
Semester 1	AGPS701(8); AGPS710(16); AGPS715(16); AGPS770(8); BIOL722(16)
Semester 2	BIOL722(16); BIOL723(16); Year Long: AGPS790(32)

4. Animal and Poultry Science

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	BIOL102(16), CHEM120(16), MATH143(8), PHYS133(8), STAT130(16)

Year 2	
Semester 1	AGEC210(16), ANSI207(16), BIOC201(16), MPHY210(16)
Semester 2	ANSI201(16), 209(16), BIOC212(16), STAT222(16)
Year 3	
Semester 1	ANSI312(16), 333(16), 352(16), GENE240(16)
Semester 2	ANSI311(16), 370(16), GENE350(16), (ZULN101(16) or Elective(16))
Year 4	
Semester 1	AGPS710(16), ANSI711(16)
Semester 2	ANSI703(16), ANSI712(16), Electives(16)
Year Modules	ANSI792(48)

5. Plant Pathology

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	CHEM120(16), STAT130(16), Electives(32)
Year 2	
Semester 1	GENE240(16), SSCI217(16), STAT221 (16), Elective(16)
Semester 2	AGPS200(16), PPTH214(16), STAT222(16), (ZULN101 or Elective(16))
Year 3	
Semester 1	PPTH305(16), 330(16), (AGPS305(16) or 307(16)), Level-3 Elective(16)
Semester 2	AGPS306(16), 320(16), PPTH370(16), (AGPS308(16) or PPTH360(16))
Year 4	
Semester 1	PPTH723(16), 730(16), 745(16), 715(16)
Semester 2	PPTH713(16)
Year Modules	PPTH750(48)

6. Soil Science

Year 1	
Semester 1	BIOL101(16), CHEM110(16), MATH150(16), PHYS131(16)
Semester 2	CHEM120(16), MATH143(8), PHYS133(8), STAT130(16), Elective(16)
Year 2	
Semester 1	AMET210(16), SSCI217(16), STAT221(16), Elective(16)
Semester 2	AGPS200(16), SSCI230(16), 260(16), (ZULN101 or Elective(16))
Year 3	
Semester 1	AGPS301(16), SSCI353(16), Electives(32, at least 16 at Level 3)
Semester 2	SSCI320(16), 373(16), Electives(32, at least 16 at Level 3)
Year 4	

Semester 1	SSCI730(16), 750(16), Elective (16)
Semester 2	Elective (16)
Year Modules	SSCI792(16), 793(48)

AES-BScAg3 Transferability of Credits

Except with the permission of the Senate, candidates may not include among the 224 credits at Levels 3 and 7 prescribed in terms of Rule AES-BScAg1(b)(iv), credits for modules passed at another university, or for modules in a subject passed at equivalent level towards the requirements of a qualification in another college, unless they are specified in the programme or major in which the candidate is registered.

AES-BScAg4 Transfers into Bachelor of Science in Agriculture

In order for third year students to be eligible to transfer into a BSc(Agric) programme they must have passed at least 96 credits of level 3 modules specified in the relevant curriculum with a credit weighted average of at least 60%. Acceptance into the BSc(Agric) programme will be based on availability of positions and on academic merit.

Degree of Bachelor of Agricultural Management

AES-BAgM1 Structure of the Degree
(a) In order to complete the qualification, a student shall obtain not less than 384 credits and shall complete the modules specified in Rule AES-BAgM2.
(b) Students registered for the first time from 2014 must pass or obtain credit for ZULN101, unless otherwise exempted in terms of Rule GR8.

AES-BAgM2 Curriculum
The curriculum shall consist of the modules laid out in the table below.

Bachelor of Agricultural Management

Year 1	
Semester 1	BIOL101(16), ECON101(16), ACCT101(16), MATH134(16)
Semester 2	ACCT103(16), ECON102(16), MGNT102(16), STAT130(16)
Year 2	
Semester 1	AGEN216(8), (HRMG2HM(16) or MARK2IM(16)), SSCI217(16), (AGEC220(16) or FINA201(16)), Elective (8)
Semester 2	(AGPS200(16) or ANSI201(16) or 209(16)), ENTR2IE(16), (AGEC270(16) or FINA202(16)), (ZULN101 or Level-2 Elective(16))
Year 3	
Semester 1	AGPS301(16), 305(16), 32Cr from (AGEC380(16), AGPS307(16), 309(16), ANSI312(16), 333(16), 352(16), FINA311(16), (HRMG3ER(16) and 31E(16)), MGNT307(16), 315(16), SCMA301(16))
Semester 2	AGEC370(16), AMAN300(16), 32C from (ANSI370(16), FINA312(16), 321(16), (HRMG3CE(16) and 30D(16)), MGNT310(16), SCMA306(16), 311(16), Level-3 Elective(16))

Note: FINA201 and 202 options in Year 2 are only for students wishing to continue to BAgricMgmt(Hons) (Commerce Stream), specializing in Finance.

Degree of Bachelor of Agriculture in Agricultural Extension

AES-BAg1 Structure of the Degree

(a) In order to complete the qualification a candidate shall obtain not less than 384 credits and shall complete the modules specified in Rule AES-BAg2.
(b) Students registered for the first time from 2014 must pass or obtain credit for ZULN101, unless otherwise exempted in terms of Rule GR8.

AES-BAg2 CurriculumThe curriculum shall consist of the modules laid out in the tables below

Bachelor of Agriculture in Agricultural Extension

Year 1	
Semester 1	AGRI151(16), EXTN161(16), FRME153(8), RMGT151(16)
Semester 2	AGRI152(16), EXTN162(16), FBMT151(16), RMGT152(16)
Year 2	
Semester 1	AGRI265(16), 267(16), EXTN261(16), FBMT262(16), RMGT262(8)
Semester 2	AGRI261(16), 266(16), EXTN262(16), (FRME262(16) or ZULN101(16))
Year 3	
Semester 1	EXTN371(16), 372(16)
Vacation	EXTN373(32)
Year Modules	FBMT371(32), RMGT371(32)

Degree of Bachelor of Science in Dietetics and Human Nutrition

AES-BDiet1 Structure of the Degree

In order to complete the qualification, a student shall obtain not less than 528 credits and shall complete the modules described in Rule AES-BDiet3.

AES-BDiet2 Additional Requirements

(a) In order to be awarded the qualification, students must pass or obtain credit for ZULN101, unless otherwise exempted in terms of Rule GR8.

(b) In terms of Section 61(1)(1)(iv A) of the Medical, Dental and Supplementary Health Service Professions Act (Act 56 of 1974), students must register with the Health Professions Council of South Africa, in their first year of study.

(c) Students' attention is drawn to implementation of the Statutory Compulsory Community Service for a one-year period upon completion of the 4 year professional BSc Dietetics and Human Nutrition degree in order to register with the Health Professions Council of South Africa (applicable to South African citizens only).

AES-BDiet3 Curriculum

The curriculum shall consist of the modules laid out in the table below. **Bachelor of Science in Dietetics (Pietermaritzburg)**

Year 1	
Semester 1	BIOL101(16), CHEM110(16), NUTR114(16), ZULN101(16) or Elective(16)
Semester 2	CHEM120(16), FSCI120(16), NUTR124(16), STAT130(16)
Year 2	
Semester 1	BIOC201(16), FSCI210(16), MPHY210(16), NUTR224(16)
Semester 2	BIOC212(16), DIET237(16), HPHY210(16), DIET251(16)
Year 3	
Semester 1	DIET380(16), 382(16), FSMT332(16), NUTR343(16)
Semester 2	NUTR312, 342(16), DIET381(16), FSMT333(16)
Year 4	
Year	DIET410(48), 420(32); FSMT410(32); NUTR410(32)

Degree of Bachelor of Science in Engineering

ECSA Exit Level Outcomes

The exit level outcomes and the competencies, as defined in the Engineering Council of South Africa (ECSA) PE-61 Publication (2004), may be assessed in individual or a combination of modules. They are included here to give the students an understanding of the levels of competencies they are expected to attain.

Exit level outcome 1: Problem solving

***Learning outcome*:** Demonstrate competence to identify, assess, formulate and solve convergent and divergent engineering problems creatively and innovatively.

Exit level outcome 2: Application of scientific and engineering knowledge

***Learning outcome*:** Demonstrate competence to apply knowledge of mathematics, basic science and engineering sciences from first principles to solve engineering problems.

Exit level outcome 3: Engineering Design

***Learning outcome*:** Demonstrate competence to perform creative, procedural and nonprocedural design and synthesis of components, systems, engineering works, products or processes.

Exit level outcome 4: Investigations, experiments and data analysis

***Learning outcome*:** Demonstrate competence to design and conduct investigations and experiments.

Exit level outcome 5: Engineering methods, skills and tools, including Information Technology

Learning outcome: Demonstrate competence to use appropriate engineering methods, skills and tools, including those based on information technology.

Exit level outcome 6: Professional and technical communication

Learning outcome: Demonstrate competence to communicate effectively, both orally and in writing, with engineering audiences and the community at large.

Exit level outcome 7: Impact of Engineering activity

Learning outcome: Demonstrate critical awareness of the impact of engineering activity on the social, industrial and physical environment.

Exit level outcome 8: Individual, team and multidisciplinary working

Learning outcome: Demonstrate competence to work effectively as an individual, in teams and in multidisciplinary environments.

Exit level outcome 9: Independent learning ability

Learning outcome: Demonstrate competence to engage in independent learning through well-developed learning skills.

Exit level outcome 10: Engineering Professionalism

Exit level outcome 11: Engineering Management

Learning outcome: Demonstrate critical awareness of the need to act professionally and ethically and to exercise judgment and take responsibility within own limits of competence. ***Note***: *All components of modules which evaluate ECSA outcomes at exit level are subject to external examination.*

AES-BE1 Structure of the degree
(a)   In order to complete the qualification a student shall obtain not less than 576 credits and shall complete the modules described in Rule AES-BE4. Of these credits at least 96 must be at Level-4 or above.
(b)   The minimum duration for the qualification is 8 semesters.
(c)   In order to complete the qualification, students registered for the first time from 2014 must pass or obtain credit for ZULN101, unless otherwise exempted in terms of Rule GR8.

AES-BE2 External Examination of Engineering Modules
In addition to the requirements of Rule GR19, Engineering modules at any level, where Engineering Council of South Africa (ECSA) exit level outcomes are evaluated, are subject to external examination.

AES-BE3 Vacation-Work Requirements
BScEng candidates are required to complete a minimum period of 14 weeks practical work for degree purposes, which could include one or more workshop training modules. Candidates shall undertake and perform such vacation work as may be approved by their discipline and shall submit an acceptable report thereon within six weeks of the start of the semester following the completion of each period of such work.

AES-BE4 Bachelor of Science in Engineering Curriculum Candidates shall obtain credit for the following modules:

1. Agricultural Engineering

YEAR 1

Semester 1		Semester 2	
CHEM163 Chemistry & Society	(8)	CHEM173 Chemistry & Society 2	(8)
ENCH1TC Tech. Comm. for Engineers	(8)	ENAG1DE Engineering Design	(8)
ENME1DR Engineering Drawing	(8)	ENAG1MT Intro. to Engineering Materials	(8)
MATH131 Mathematics 1A (Eng)	(16)	MATH141 Mathematics 1B (Eng)	(16)
MATH132 Applied Mathematics 1A (Eng)	(16)	MATH142 Applied Mathematics 1B (Eng)	(16)
PHYS110 Mech., Optics & Thermal Phys	(16)	PHYS120 Electromag, Waves & Mod. Phys	(16)

YEAR 2

Semester 1		Semester 2	
ENCV2SA Structures 1	(16)	ENCV2FL Fluids 1	(8)
ENEL2EE Electrical and Electronic Eng or	(16)	ENEL2EN Environmental	(8)
ENAG4EA Elec. Applications for Bio-	(8)	Engineering or	
Systems and		ENVS322 Environmental	(16)
ENAG4SE Sustainable Energy for Bio-Systs	(8)	Management	
ENME2TH Thermodynamics 1	(8)	ENCV2SB Structures 2	(16)
ENSV2SE Surveying Engineering	(16)	ENCV2SD Structural Design 1	(16)
ENCV3G1 Geotechnical Engineering Studies	(16)	ENME2DM Design Methods	(16)
		ENME3TH Thermodynamics 2	(8)

YEAR 3

Semester 1		Semester 2	
HYDR210 Introduction to Physical Hydrology	(16)	AGEC240 Applied Farm Financial Mgmt	(8)
MATH212 Advanced Calculus & Lin. Alg.	(16)	ENAG3SA Structural Analysis & Design	(8)
or MATH238 Mathematics 2A (Eng)	(16)		
COMP100 Introduction to Computer Science or	(16)	STAT130 Introduction to Statistics	(16)
ENEL2CM Applied Computer Methods and	(8)		
ENME2CF Computer Fundamentals	(8)		
ENAG3EP Bioresources Engineering Practice	(DP)	MATH251 Further Calculus and Intro Analysis or	(16)
Workshop		MATH248 Mathematics 2B (Eng)	(16)
		ENAG3US Undergraduate Seminar	(8)

24 Credits selected from the following (or as approved by the Dean & Head of School)		16 Credits selected from the following (or as approved by the Dean & Head of School)	
ENAG3EI Irrigation Engineering*	(16)	ENAG3FE Forest Engineering*	(8)
ENAG3FP Principles of Food Processing*	(8)	ENAG4AP Advanced Power & Traction*	(8)
ENAG3PT Power & Traction*	(8)	ENAG4EA Elec. Applications for Bio-Systems*	(8)
ENAG3ST Selected Topics	(8)	ENAG4EC Env. Control of Biol. Commodities*	(8)
ENAG4BM Bio-Production Systems & Mgmt*	(16)	ENAG4FE Food Engineering Unit Operations*	(8)
		ENAG4SW Soil & Water Conservation Eng*	(8)
		HYDR322 Environmental Water Quality	(8)
		HYDR330 Water Res. Policy, Laws & Institutions	(8)

*Denotes modules offered in alternate years.

YEAR 4

Year Modules	
ENAG4ED Agricultural Engineering Design Project	(32)
ENAG4EP ECSA Outcomes Portfolio	(DP)

Semester 1		Semester 2	
ENAG3US Undergraduate Seminar	(8)	ENAG4VW Vacation Work	(DP)
HYDR310 Modelling for Hydrological Design	(16)	ZULN101 Basic isiZulu Language Studies A or Electives (Complementary studies)	(16)
24 Credits selected from the following (or as approved by the Dean & Head of School) ENAG3EI Irrigation Engineering	(16)	**24 Credits selected from the following (or as approved by the Dean & Head of School)** ENAG3FE Forest Engineering*	(8)
ENAG3FP Principles of Food Processing*	(8)	ENAG4AP Advanced Power & Traction*	(8)
ENAG3PT Power & Traction*	(8)	ENAG4EA Elec. Applications for Bio-Systems*	(8)
ENAG4BM Bio-Production Systems & Mgmt*	(16)	ENAG4EC Env. Control of Biol. Commodities*	(8)
ENAG4ST Selected Topics in Engineering	(16)	ENAG4FE Food Engineering Unit Operations*	(8)
		ENAG4SE Sustainable Energy for Bio-Systs*	(8)
		ENAG4ST Selected Topics in Engineering	(16)
		ENAG4SW Soil & Water Conservation Eng*	(8)
		HYDR322 Environmental Water Quality	(8)
		HYDR324 Applied Hydrology	(8)
			(8)

	HYDR330 Water Res. Policy, Laws & Institutions	(8)
16 Credits selected from the following (or as approved by the Dean & Head of School)	**16 Credits selected from the following (or as approved by the Dean & Head of School)**	
AGPS305 Field Crop Management (16) AGPS307 Orchard Management (16) SSCI217 Intro. to Soils & the Environment (16)	AGPS732 Postharvest Technology (16) COMP102 Computer Programming (16) ENVS211 Geographic Information Systems (16) SSCI230 Pedology (16)	

* Denotes modules offered in alternate years.

2. Chemical Engineering

YEAR 1

Semester 1		Semester 2	
ENCH1EA Chemical Engineering Principles 1	(8)	ENCH1EB Chemical Engineering Principles 2	(8)
ENCH1TC Tech. Communication for Engineers	(8)	CHEM171 Chemical Engineering Chemistry 2	(16)
CHEM161 Chemical Engineering Chem. 1	(16)	MATH141 Mathematics 1B (Eng)	(16)
MATH131 Mathematics 1A (Eng)	(16)	MATH142 Applied Mathematics 1B (Eng)	(16)
MATH132 Applied Mathematics 1A (Eng)	(16)	PHYS162 Chemical Engineering Physics 1B	(16)
PHYS161 Chemical Engineering Physics 1A	(8)		

YEAR 2

Semester 1		Semester 2	
CHEM241 Appl. Organic Chem for Chem Eng	(8)	CHEM251 Appl Physical Chem for Chem Eng	(8)
ENCH2MB Mass and Energy Balances	(8)	ENCH2EF Chemical Engineering Fundamentals	(16)
ENCH2OM Oil & Mineral Processing	(8)	ENCH2ET Exptl Techniques & Measurements	(16)
ENEL2CM Applied Computer Methods	(8)	ENCH2MS Materials of Construction	(8)
ENEL2EE Electrical & Electronic Engineering	(16)	ENCH2TD Thermodynamics 1	(8)
ENME1DR Engineering Drawing	(8)	MATH248 Mathematics 2B (Eng)	(16)
MATH238 Mathematics 2A (Eng)	(16)	ENCH2WS Workshop Training	(DP)

YEAR 3

Semester 1		Semester 2	
CHEM261 Appl Inorganic Chem for Chem Eng	(8)	ENCH3CP Chemical Engineering Practicals 2	(8)
ENCH3FM Fluid Mechanics	(8)	ENCH3ED Chemical Engineering Design	(16)
ENCH3HE Heat Transfer	(16)	ENCH3MT Mass Transfer	(16)
ENCH3MP Materials Processing	(8)	ENCH3PO Process Modelling & Optimization	(16)
ENCH3SL Safety & Loss Prevention	(8)	ENCH3RT Reactor Technology Fundamentals	(16)
ENCH3FS Fluid and Solids Transport	(16)		
ENCH3TH Thermodynamics 2	(8)		
MATH354 Mathematics 3A (Eng)	(8)		
STAT370 Engineering Statistics	(16)		

YEAR 4

Semester 1		Semester 2	
ENCH4DC Process Dynamics and Control	(16)	ENCH4DP Design Project	(32)
ENCH4LA Laboratory/Industry Project 1	(16)	ENCH4PE Projects and the Environment	(8)
ENCH4ML Eng Management & Labour Relns	(8)	ENEL4EB Engineering Business	(8)
ENCH4MT Advanced Mass Transfer	(8)	ENCH4VW Practical Vacation Work (12 weeks)	(DP)
ENCH4RT Applied Reactor Technology	(8)		
Plus one of the following modules (Engineering modules): ENCH4CA Chemical Engineering Topics 1 (8) ENCH4CG Coal Technology and Gasification (8) ENCH4MP Mineral Processing (8) ENCH4WP Wood Pulping Technology (8) ENCH4BG Biorefinery Concept & Green Technologies (8)		**Plus one of the following modules (Engineering modules)**: ENCH4AB Applied Biochemical Engineering (8) ENCH4CB Chemical Engineering Topics 2 (8) ENCH4EI Environmental Impact Assessment (8) ENCH4EM Extractive Metallurgy (8) ENCH4LB Laboratory/Industry Project 2 (8) ENCH4PM Paper Making Technology (8) ENCH4PP Petroleum & Synthetic Fuel Process (8)	
ZULN101 Basic isiZulu Language Studies A or Elective module (complementary studies)*	(16)	Elective modules 1(complementary studies)*	(16)

*Registration for elective modules can be done only with the approval of Programme co-ordinator.

3. Civil Engineering

YEAR 1

Semester 1		Semester 2	
CHEM181 Chemistry for Engineers 1A or	(8)	CHEM191 Chemistry for Engineers 1B or	(8)
CHEM163 Chemistry & Society 1	(8)	CHEM173 Chemistry & Society 2	(8)
ENCH1TC Tech. Comm. for Engineers	(8)	ENME1EM Intro. to Engineering Materials	(8)
		or ENAG1MT Intro. to Engineering Materials	(8)
ENME1DR Engineering Drawing	(8)	ENCV1ED Introduction to Civil Design	(8)
		or ENAG1DE Engineering Design	(8)
MATH131 Mathematics 1A (Eng)	(16)	MATH141 Mathematics 1B (Eng)	(16)
MATH132 Applied Mathematics 1A (Eng)	(16)	MATH142 Applied Mathematics 1B (Eng)	(16)
PHYS151 Engineering Physics 1A or PHYS110	(16)	PHYS152 Engineering Physics 1B or	(16)
Mech., Optics & Thermal Phys	(16)	PHYS120 Electromag, Waves & Mod. Phys	(16)
		ENCV1EP Engineering Practice Workshop	(DP)

YEAR 2

Semester 1		Semester 2	
ENCV2MT Civil Engineering Materials	(8)	ENCV2FL Fluids 1	(8)
ENCV2SA Structures 1	(16)	ENCV2SB Structures 2	(16)
ENSV2SE Surveying Engineering	(16)	ENCV2SD Structural Design 1	(16)
MATH238 Mathematics 2A (Eng)	(16)	GEOL215 Elements of Geology for Civil Eng.	(16)
ZULN101 Basic isiZulu Language Studies A or Electives	(16)	MATH248 Mathematics 2B (Eng)	(16)
		ENCV2MW Materials workshop	(DP)

YEAR 3

Semester 1		Semester 2	
ENCV3FA Fluids 2	(16)	ENCV3FB Fluids 3	(16)
ENCV3G1 Geotech. Engineering Studies 1	(16)	ENCV3G2 Geotech. Engineering Studies 2	(16)
ENCV3ST Structures 3	(16)	MATH360 Numerical Methods	(8)
ENCV3TT Transport 1	(16)	ENCV3SD Structural Design 2	(16)
STAT370 Engineering Statistics	(8)	ENCV3TP Transport 2	(8)
		Elective	(8)
		ENCV3CW Civil CADD workshop	(DP)

YEAR 4

Semester 1		Semester 2	
ENCH4ML Eng. Management & Labour Relatns	(8)	ENCV4DE Civil Engineering Design Project	(24)
ENCV4GS Ground & Structural Engineering	(16)	ENCV4DS Dissertation	(24)
ENCV4TE Transport & Environmental Mgmt	(16)	ENPD7CL Mgmt. of Construction Contracts	(8)
ENCV4WE Water & Environmental Eng.	(16)	Electives	(16)
ENPD7PP Professional Practice	(8)	ENCV4VW Practical Vacation Work	(DP)
Elective	(8)		

Civil Engineering candidates must complete 48 credits of elective modules of which at least 32 credits must be in Social Studies and Humanities. A minimum of 8 credits of electives will be required at 4th year level. The Dean and Head of School must approve all electives.

4. Computer Engineering

YEAR 1

Semester 1		Semester 2	
CHEM181 Chemistry for Engineers 1A or	(8)	CHEM191 Chemistry for Engineers 1B or	(8)
CHEM163 Chemistry & Society 1	(8)	CHEM173 Chemistry & Society 2	(8)
ENCH1TC Tech. Communication for Engineers	(8)	ENEL1ED Electrical Design 1 or	(8)
		ENAG1DE Engineering Design	(8)
ENME1DR Engineering Drawing	(8)	ENME1EM Intro to Engineering Materials or	(8)
		ENAG1MT Intro. to Engineering Materials	(8)
MATH131 Mathematics 1A(Eng)	(16)	MATH141 Mathematics 1B(Eng)	(16)
MATH132 Applied Mathematics 1A(Eng)	(16)	MATH142 Applied Mathematics 1B(Eng)	(16)
PHYS151 Engineering Physics 1A or	(16)	PHYS120 Electromag, Waves & Mod. Phys or	(16)
PHYS110 Mech., Optics & Thermal Phys	(16)	PHYS152 Engineering Physics 1B	(16)

YEAR 2

Semester 1		Semester 2	
ENEL2CA Computer Methods 1	(8)	ENEL2CB Computer Methods 2	(8)
ENEL2EA Electrical Principles 1	(16)	ENEL2DS Data Structures & Algorithms	(8)
MATH238 Mathematics 2A(Eng)	(16)	ENEL2EB Electrical Principles 2	(16)
MATH239 Applied Finite Mathematics	(8)	ENEL2EN Environmental Engineering	(8)
PHYS251 Optics and Wave Motion	(8)	ENEL2FT Field Theory	(8)
ZULN101 Basic isiZulu Language Studies A or Elective	(16)	ENEL2SE Software Engineering 1	(8)
		MATH248 Mathematics 2B(Eng)	(16)
		ENEL2WS Workshop Training	(DP)

YEAR 3

Semester 1		Semester 2	
ENCH4ML Engineering Mgmt & Labour Relns	(8)	ENEL3AE Analogue Electronics 2	(8)
ENEL3CA Computer Engineering Design 1	(8)	ENEL3CB Computer Engineering Design 2	(8)
ENEL3CC Computer Methods 3	(8)	ENEL3CO Communications	(16)
ENEL3DS Digital Systems	(16)	ENEL3CS Control Systems 1	(8)
ENEL3SS Systems and Simulation	(8)	ENEL3DE Digital Electronics	(8)
ENEL3TA Analogue Electronics 1	(8)	ENEL3SF Software Engineering 2	(8)
MATH354 Mathematics 3(Eng)	(8)	MATH349 Discrete Mathematics	(8)
STAT370 Engineering Statistics	(8)	MATH360 Numerical Methods	(8)

YEAR 4

Semester 1		Semester 2	
ENEL4AA Design & Analysis of Algorithms	(8)	ENEL4CB Computer Eng. Design Project	(32)
ENEL4CA Computer Engineering Design 3	(16)	ENEL4EB Engineering Business	(8)
ENEL4CO Computer Architecture & Org.	(8)	ENEL4ES Embedded Systems	(8)
ENEL4DC Digital Communications	(8)	ENEL4IE Internet Engineering	(8)
ENEL4DT Data Communications	(8)	ENEL4RC Real Time Computing	(8)
ENEL4EE Engineering Entrepreneurship	(8)	ENEL4VW Vacation Work	(DP)
ENEL4OS Operating Systems for Engineers	(8)		
Plus two from the following options			
ENEL4CM E-commerce Systems	(8)	ENEL4AI Artificial Intelligence	(8)
ENEL4CS Control Systems 2	(8)	ENEL4CC Distributed Computing Systems	(8)
ENEL4DS Digital Signal Processing	(8)	ENEL4IP Image Processing	(8)
ENEL4SE Security and Encryption	(8)	ENEL4ST Selected Topics in Computer	(8)
ENEL4TC Selected Topics in Computer Eng.1	(8)	Eng.2	
		ENEL4VL VLSI Design	(8)

5. Electrical Engineering

YEAR 1

Semester 1		Semester 2	
CHEM181 Chemistry for Engineers 1A or	(8)	CHEM191 Chemistry for Engineers 1B or	(8)
CHEM163 Chemistry & Society 1	(8)	CHEM173 Chemistry & Society 2	(8)
ENCH1TC Tech. Communication for Engineers	(8)	ENEL1ED Electrical Design 1 or	(8)
		ENAG1DE Engineering Design	(8)
ENME1DR Engineering Drawing	(8)	ENME1EM Intro. to Engineering Materials	(8)
		or ENAG1MT Intro. to Engineering Materials	(8)
MATH131 Mathematics 1A(Eng)	(16)	MATH141 Mathematics 1B(Eng)	(16)
MATH132 Applied Mathematics 1A(Eng)	(16)	MATH142 Applied Mathematics 1B(Eng)	(16)
PHYS151 Engineering Physics 1A or	(16)	PHYS120 Electromag, Waves & Mod. Phys or	(16)
PHYS110 Mech., Optics & Thermal Phys	(16)	PHYS152 Engineering Physics 1B	(16)

YEAR 2

Semester 1		Semester 2	
ENEL2CA Computer Methods 1	(8)	ENEL2CB Computer Methods 2	(8)
ENEL2EA Electrical Principles 1	(16)	ENEL2EB Electrical Principles 2	(16)
ENME2MS Material Strengths	(8)	ENEL2ED Electrical Design 2	(8)
ENME2TF Thermofluids	(8)	ENEL2EN Environmental Engineering	(8)
MATH238 Mathematics 2A(Eng)	(16)	ENEL2FT Field Theory	(8)
MATH239 Applied Finite Mathematics	(8)	ENEL2NP Nuclear & Semiconductor Physics	(8)
PHYS251 Optics and Wave Motion	(8)	MATH248 Mathematics 2B(Eng)	(16)
		ENEL2WS Workshop Training	(DP)

YEAR 3

Semester 1		Semester 2	
ENCH4ML Engineering Mgmt & Labour Relns	(8)	ENEL3AE Analogue Electronics 2	(8)
ENEL3EA Electrical Design 3	(8)	ENEL3CS Control Systems 1	(8)
ENEL3DS Digital Systems	(16)	ENEL3DE Digital Electronics	(8)
ENEL3MA Electrical Machines 1	(8)	ENEL3EB Electrical Design 4	(8)

ENEL3SS Systems and Simulation	(8)	ENEL3EM E-M Theory	(8)
ENEL3TA Analogue Electronics 1	(8)	ENEL3MB Electrical Machines 2	(8)
MATH354 Mathematics 3 (Eng)	(8)	ENEL3PE Power Electronics 1	(8)
STAT370 Engineering Statistics	(8)	ENEL3PS Power Systems 1	(16)

YEAR 4

Semester 1		Semester 2	
Compulsory modules			
ENEL4EA Electrical Design 5	(24)	ENEL4EB Engineering Business	(8)
ENEL4EE Engineering Entrepreneurship	(8)	ENEL4EP Electrical Design Project	(32)
ENEL4WA Power Systems 2	(8)	ENEL4VW Vacation Work	(DP)
ENEL4HA High Voltage Engineering 1	(8)	ZULN101 Basic Isizulu Language Studies 1A or Elective	(16)
Two 8cr or one 16cr module from outside the College taken in either semester and chosen with the approval of the School			
Optional modules. These must be chosen to account for 56cr in total. At least one of these modules must be a self-study module.			
Between 0C and 56C from			
ENEL4CS Control Systems 2	(8)	ENEL4HB High Voltage Engineering 2	(8)
ENEL4MA Electrical Machines 3	(8)	ENEL4MB Electrical Machines 4	(8)
ENEL4PA Power Electronics 2	(8)	ENEL4ES Embedded Systems	(8)
ENEL4SA Selected Topics in Engineering 1(Self Study)	(8)	ENEL4IL Illumination	(8)
		ENEL4SB Selected Topics in Engineering 2(Self Study)	(8)

6. Electronic Engineering

YEAR 1

Semester 1		Semester 2	
CHEM181 Chemistry for Engineers 1A Or	(8)	CHEM191 Chemistry for Engineers 1B or	(8)
CHEM163 Chemistry & Society 1	(8)	CHEM173 Chemistry & Society 2	(8)
ENCH1TC Tech. Communication for Engineers	(8)	ENEL1ED Electrical Design 1 or	(8)
		ENAG1DE Engineering Design	(8)
ENME1DR Engineering Drawing	(8)	ENME1EM Intro. to Engineering Materials or	(8)
		ENAG1MT Intro. to Engineering Materials	(8)
MATH131 Mathematics 1A(Eng)	(16)	MATH141 Mathematics 1B(Eng)	(16)
MATH132 Applied Mathematics 1A(Eng)	(16)	MATH142 Applied Mathematics 1B(Eng)	(16)
PHYS151 Engineering Physics 1A or	(16)	PHYS120 Electromag, Waves & Mod. Phys or	(16)
PHYS110 Mech., Optics & Thermal Phys	(16)	PHYS152 Engineering Physics 1B	(16)

YEAR 2

Semester 1		Semester 2	
ENEL2CA Computer Methods 1	(8)	ENEL2CB Computer Methods 2	(8)
ENEL2EA Electrical Principles 1	(16)	ENEL2ED Electrical Design 2	(8)
ENEL2PA Physical Electronics 1	(8)	ENEL2EB Electrical Principles 2	(16)
ENME2TF Thermofluids	(8)	ENEL2EN Environmental Engineering	(8)
MATH238 Mathematics 2A (Eng)	(16)	ENEL2FT Field Theory	(8)
MATH239 Applied Finite Mathematics	(8)	ENEL2PB Physical Electronics 2	(8)
PHYS251 Optics and Wave Motion	(8)	MATH248 Mathematics 2B (Eng)	(16)
		ENEL2WS Workshop Training	(DP)

YEAR 3

Semester 1		Semester 2	
ENEL3CC Computer Methods 3	(8)	ENEL3AE Analogue Electronics 2	(8)
ENEL3DA Electronic Design 1	(8)	ENEL3CO Communications	(16)
ENEL3DS Digital Systems	(16)	ENEL3CS Control Systems 1	(8)

ENEL3SS Systems and Simulation	(8)	ENEL3DB Electronic Design 2	(8)
ENEL3TA Analogue Electronics 1	(8)	ENEL3DE Digital Electronics	(8)
MATH354 Mathematics 3 (Eng)	(8)	ENEL3EM E-M Theory	(8)
STAT370 Engineering Statistics	(8)	ENEL3PE Power Electronics 1	(8)
ENCH4ML Engineering Mgmt & Labour Relns	(8)	MATH360 Numerical Methods	(8)

YEAR 4

Semester 1		Semester 2	
Compulsory modules			
ENEL4DA Electronic Design 3	(16)	ENEL4EB Engineering Business	(8)
ENEL4EC Analogue Electronics 3	(8)	ENEL4ED Electronic Design Project	(32)
ENEL4DS Digital Signal Processing	(8)	ENEL4TB Selected Topics in Electronic Eng.	(8)
ENEL4EE Engineering Entrepreneurship	(8)	ZULN101 Basic isiZulu Language Studies 1A or Elective	(16)
		ENEL4VW Vacation Work	(DP)
Two 8C or one 16C module from outside the Colleg the School. taken in either semester and chosen with approval of the school			
Optional modules. These must be chosen to account for 40Cr in total.			
Between 24C and 32C from			
ENEL4CS Control Systems 2	(8)		
ENEL4DC Digital Communications	(8)		
ENEL4DP Digital Processes	(8)		
Between 16C and 24C from			
ENEL4AC Acoustics	(8)	ENEL4AI Artificial Intelligence	(8)
ENEL4DT Data Communications	(8)	ENEL4AM Automation	(8)
ENEL4IN Instrumentation	(8)	ENEL4ES Embedded Systems	(8)
ENEL4PA Power Electronics 2	(8)	ENEL4IP Image Processing	(8
ENEL4TA Selected topics in Electronic Eng 1	(8)	ENEL4MS Microwave Systems	(8)
		ENEL4SC Superconductivity	(8)
		ENEL4SY Communication Systems	(8)

7. Mechanical Engineering

YEAR 1

Semester 1		Semester 2	
CHEM181 Chemistry for Engineers 1A or	(8)	CHEM191 Chemistry for Engineers 1B	(8)
CHEM163 Chemistry & Society 1	(8)	or CHEM173 Chemistry & Society 2	(8)
ENCH1TC Tech. Comm. for Engineers	(8)	ENME1EM Intro. to Engineering Materials	(8)
		or ENAG1MT Intro. to Engineering Materials	(8)
ENME1DR Engineering Drawing	(8)	ENME1ED Mechanical Engineering Design	(8)
		or ENAG1DE Engineering Design	(8)
MATH131 Mathematics 1A (Eng)	(16)	MATH141 Mathematics 1B (Eng)	(16)
MATH132 Applied Mathematics 1A (Eng)	(16)	MATH142 Applied Mathematics 1B (Eng)	(16)
PHYS151 Engineering Physics 1A or PHYS110	(16)	PHYS152 Engineering Physics 1B or	(16)
Mech., Optics & Thermal Phys	(16)	PHYS120 Electromag, Waves & Mod. Phys	(16)

YEAR 2

Semester 1		Semester 2	
ENEL2EL Electrical Engineering	(16)	ENEL2EC Electronic Engineering	(8)
ENME2CF Computer Fundamentals	(8)	ENEL2EN Environmental Engineering	(8)
ENME2DY Dynamics	(8)	ENME2DM Design Methods	(16)
ENME2FM Fluid Mechanics 1	(8)	ENME2MM Measurements & Exptl Methods	(8)
ENME2PM Funds of Physical Metallurgy	(8)	ENME2SM Strength of Materials 1	(16)
ENME2TH Thermodynamics 1	(8)	MATH248 Mathematics 2B (Eng)	(16)
MATH238 Mathematics 2A (Eng)	(16)	ENME2WS Workshop Course	(DP)

YEAR 3

Semester 1		Semester 2	
ENCH4ML Eng. Mgmt & Labour Relations	(8)	ENEL3CS Control Systems 1	(8)
ENEL3MA Electrical Machines 1	(8)	ENME3FM Fluid Mechanics 2	(16)
ENEL3SS Systems and Simulation	(8)	ENME3HM Heat & Mass Transfer 1	(16)
ENME3DM Design of Machine Elements	(16)	ENME3MT ManufacturingTechnology	(8)
ENME3ST Strength of Materials 2	(16)	ENME3SM Selection of Engineering Materials	(8)

| MATH354 Mathematics 3 (Eng) | (8) | ENME3TH Thermodynamics 2 | (8) |
| STAT370 Engineering Statistics | (8) | ENME3TM Theory of Machines | (8) |

YEAR 4

Semester 1		Semester 2	
ENME4AM Advanced Manufacturing Systems	(8)	ENEL4EE Engineering Entrepreneurship	(8)
ENME4CM Eng. Computational Methods	(8)	ENME4DP Design and Research Project 2	(24)
ENME4FP Design of Fluid Power Systems	(8)	ENME4MT Mechatronic Engineering	(8)
ENME4PD Design and Research Project 1	(16)	ENME4MV Mechanical Vibrations	(8)
ENME4TD Thermodynamics 3	(8)	ENME4VW Vacation Work	(DP)
ZULN101 Basic isiZulu Language Studies A or Elective	(16)		
Elective modules (see note 1) ENEL4EB Engineering Business (8) ENME4DM Design & Analysis of Mnfting Proc. (8) ENME4ES Alternative Energy Systems (8) ENME4MC Mechanics of Composite Materials (8) ENME4ME Selected Topics in Mech. Eng 1 (8)		*Elective modules (see note 1)* ENME4ED Mechanical Engineering Design (8) ENME4EM Energy Management (8) ENME4FF Fracture & Fatigue of Eng. Materials (8) ENME4MN Selected Topics in Mech. Eng. 2 (8) MATH360 Numerical Methods (8) Free elective modules (see note 2)	

Notes:

1. *A student shall take a total of 48 elective credits to be selected following consultation with, and approval by the Dean and Head of School.*
2. *Free elective modules are modules offered outside the College. Each student must complete a minimum of **24** credits, and a maximum of **32** credits of free elective modules. Any selected module(s) shall require the approval of the Dean and Head of School, and the Dean and Head of the School offering the module.*
3. *The remaining credits, to total **48** credits, should be selected from modules in Mechanical Engineering.*

Degree of Bachelor of Science in Land Surveying

AES-BLS1 Structure of the degree

(a) In order to complete the qualification a student shall obtain not less than 576 credits and shall complete the modules described in Rule AES-BL2.

(b) Students registered for the first time from 2014 must pass or obtain credit for the ZULN101, unless otherwise exempted in terms of Rule GR8.

AES-BLS2 Bachelor of Science in Land Surveying Programme Candidates

shall obtain credit for the following modules:

Bachelor of Science in Land Surveying (Howard College)

YEAR 1

Semester 1		Semester 2	
ENCH1TC Tech. Comm. for Engineers	(8)	ENSV1G2 Geomatics 2	(16)
ENSV1G1 Geomatics 1	(16)	ENSV1GM Introduction to Geomorphology	(8)
MATH131 Mathematics 1A (Eng)	(16)	MATH141 Mathematics 1B (Eng)	(16)
MATH132 Applied Mathematics 1A (Eng)	(16)	MATH142 Applied Mathematics 1B (Eng)	(16)
PHYS151 Engineering Physics 1A	(16)	PHYS152 Engineering Physics 1B	(16)

YEAR 2

Semester 1		Semester 2	
ENSV2SV Spatial Modelling and Visualisation	(16)	ENSV2T2 Theory of Adjustments 2	(16)
ENSV2LY Layout Design	(16)	ENVS211 GIS	(16)
ENSV2T1 Theory of Adjustments 1	(16)	LAWS2PR Property	(16)
MATH238 Mathematics 2A Eng	(16)	ZULN101 Basic isiZulu Language Studies A or Elective	(16)
PHYS251 Optics and Wave Motion	(8)	ENSV2SC Survey Camp 2 (in July vacation)	(8)

YEAR 3

Semester 1		Semester 2	
ENEL2CA Computer Methods 1 or ENME2CF Computer Fundamentals	(8) (8)	ENSV3CS Cadastral Surveying 2	(16)
ENSV2CS Cadastral Surveying 1	(16)	ENSV3SE Engineering Surveying 2	(16)
ENSV2HY Hydrographic Surveying	(16)	ENSV3SS Satellite Surveying	(16)
ENVS316 GIS & Remote Sensing	(16)	ENSV3CG Co-ord Systems & Geodetic Projs	(16)
ENSV3PO Photogrammetry	(16)	ENSV3SC Survey Camp 3 (in July vacation)	(8)

YEAR 4

Semester 1		Semester 2	
ENPD7PP Professional Practice	(8)	ENEL4EB Engineering Business or ENEL4EE Engineering Entrepreneurship	(8) (8)
ENSV4GY Geodesy	(16)	ENSV4PE Precise Engineering Surveying	(16)
ENSV4TN Land Tenure	(16)	ENSV4PO Photogrammetry 2	(16)
ENPD3PL Project Planning	(16)	ENSV4SP Surveying and Mapping Project	(32)
ENSV4RM Research Methodology	(8)		
ENSV4PL Planning Law	(8)		

HONOURS DEGREES

AES-H1 Applicability of Rules

The following rules apply to the following Honours qualifications offered by the College.

Bachelor of Agriculture Honours

BAgricHons

Bachelor of Agricultural Management Honours

BAgricMgmtHons

Bachelor of Science Honours

BScHons

Bachelor of Science Honours in Construction Management

BScHons(CM)

Bachelor of Science Honours in Quantity Surveying

BScHons(QS)

AES-H2 Eligibility

Refer to General Academic Rule HR2. For selection purposes a credit weighted average of the relevant Level-3 modules will be taken into account.

AES-H3 Structure of the Degree

(a) For a BAgricHons, BAgricMgmtHons or BScHons, in order to complete the degree, a student shall obtain not less than 128 credits. At least 32 credits must be a research project.

(b) For a BScPropDevHons(CM) or a BScPropDevHons(QS), in order to complete the degree, a student shall obtain not less than 128 credits at Level 7.

AES-H4 Project Modules

The General Academic Rule HR6 applies to the following project modules, which may not be repeated:

BScHons: AGPS790, ANSI792, BIOC702, BIOL790, CHEM791, CHEM793, COMP700, EART730, ENVS730, GEOG730, GENE701, GEOL707, HYDR730, MATH798, MATH799, MICR710, PHYS709, PHYS735, PHYS760, PHYS761, PPTH750, SSCI793, STAT795.

BAgricHons: RRMG730

BAgricMgmtHons: AGPS790, AMAN790, ANSI792

BScPropDevHons: ENCS7RR.

Degree of Bachelor of Science (Honours)

AES-H5 Bachelor of Science Honours - Combinations

The following lists give the programmes of study within the degree of Bachelor of Science Honours. All elective modules must be chosen in accordance with Rule AES-H3 and require approval by the Dean and Head of School.

1. Applied Mathematics (Pietermaritzburg, Westville)

Prerequisites: Completion of a major or programme in Applied Mathematics or equivalent approved by the Dean and Head of School.

a. Pietermaritzburg
Core: MATH798(32).
Electives: 96C from MATH730(16), 731(16), 732(16), 733(16), 734(16), 740(16), 741(16), 755(16), 765(16), 785(16) or other modules approved by the School.

b. Westville
Core: MATH798(32).
Electives: 96C from Level-7 MATH. (Up to 32 of these credits may be replaced by Level 7 credits outside the School, approved by the School.)

2. Biochemistry

Prerequisites: Completion of a major or programme in Biochemistry. **a.**
Pietermaritzburg
Core: BIOC701(16), 702(48), 703(16), 705(16), 707(16), 710(16). **b.**
Westville
Core: BIOC702(48), 708(16), 709(16), 711(16), 713(16), 715(16).

3. Biological Sciences (Pietermaritzburg, Westville)

Prerequisites: Completion of a major or programme in the Biological Sciences. Note that acceptance into the programme may depend on availability of places.

a. Pietermaritzburg
Core: BIOL701(16), 790(48). *Electives*: 48C from BIOL722(16), 723(16), 724(16), 726(16), 733(16), 734(16), 763(16), 764(16) and a further 16C chosen freely from Level-7 modules within the College.

b. Westville
Core: BIOL701(16), 790(48).

Electives: 48C from BIOL712(16), 715(16), 716(16), 735(16), 738(16), 742(16), 747(16), 751(16), 702(16), GENE751(16), 752(16) and a further 16C chosen freely from Level-7 modules within the School.

4. Biometry (Pietermaritzburg)
Prerequisites: BMET314(8), BMET316(8) and completion of a major in Statistics.
Core: STAT714(16), 730(16), 740(16), 795(32). The project (STAT795) must be in Biometry.
Electives: 48C from STAT710(16), 711(16), 719(16), 723(16), 752(8), 753(16), 754(16).

5. Chemistry (Pietermaritzburg, Westville)
Prerequisites: Completion of a major or programme in Chemistry.
a. Pietermaritzburg
Core: CHEM733(16), 743(16), 753(8), 763(32), 773(8), 793(48).
b. Westville
Core: CHEM751(16), 761(48), 781(32), 791(32).

6. Computer Science (Pietermaritzburg, Westville)
Prerequisites: Completion of a major or programme in Computer Science. Note that acceptance into the programme may depend on the availability of places.
Core: COMP700(32).
Electives: 64C Computer Science at Level 7 plus 32C approved by the School.

7. Crop Science (Pietermaritzburg)
Prerequisites: Completion of the BSc programme in Crop and Horticultural Sciences or an appropriate major.
Core: AGPS701(8), 710(16), 712(16), 714(16), 715(16), 790(32), 791(8). *Electives*:
16C at Level 7 or 8 approved by the School.

8. .Ecological Sciences (Rangeland & Wildlife Conservation Stream) (Pietermaritzburg)
Prerequisites: Completion of a major or programme in Ecological Sciences or Grassland Science. Note that acceptance into the programme may depend on availability of places.
Core: BIOL701(16), 790(48).
Electives: 32C from (BIOL723(16), 724(16), 764(16)), 16C from (BIOL722(16), 723(16), 724(16), 726(16), 764(16)) and a further 16C chosen from relevant Level-7 modules within the College approved by the School.

9. Environmental Earth Science (Pietermaritzburg)

This Programme will not be offered in 2020.

This is a *multidisciplinary* qualification. Students registering for 48 credits or more in a single discipline (excluding the research project) should register in that discipline.

Prerequisites: Completion of a BSc degree with a major or programme in Environmental Earth Sciences, or equivalent. Acceptance is dependent on the availability of places.

Core: ENVS700(16), EART730(48)

Electives: 64 credits chosen from AMET, ENVS, HYDR or SSCI modules and approved by the School.

10. Environmental Science (Pietermaritzburg, Westville)

This is a *multidisciplinary qualification*. Students registering for 48 credits or more in a single discipline (excluding the research project) should register in the discipline from which the majority of the course credits are derived.

a. Pietermaritzburg

Prerequisites: Completion of BSc degree with a major or programme in Environmental Science, Biology, Geography, Geology, Hydrology or Soil Science.Acceptance is dependent on the availability of places.

Core: ENVS700(16), 730(48).

Electives: 64C chosen from Level 7 AMET, BIOL, ENVS, HYDR, or SSCI approved by the School including a maximum of 16C from GEOG approved by the School.

b. Westville

Prerequisites: Completion of a BSc degree with a major or programme in Biological Sciences, Environmental Science, Geography or Geology. Acceptance is dependent on the availability of places.

Core: ENVS700(16), 730(48).

Electives: 64C chosen from Level 7 BIOL, ENVS, GEOL or other modules from related disciplines approved by the School including a maximum of 16C from GEOG approved by the School

11. Forensic Genetics (Westville)

Prerequisites: Completion of a major in Biochemistry, Cellular Biology, Genetics, Microbiology or programme in Biological Sciences, or similar qualification. At least one 16 credit Statistics module and one 16 credit Molecular Biology/Genetics module at levels 2 and 3 is required.

Core: Semester 1 - BIOL701 (16), GENE751 (16), GENE753 (16); Semester 2 - GENE752 (16) (prerequisite GENE751), GENE755 (16) (prerequisite GENE751; corequisite GENE752); Semesters 1 and 2 - GENE756 (48).

12. Genetics (Pietermaritzburg, Westville)
Prerequisites: Completion of a major or programme in Genetics.
a. Pietermaritzburg
Core: GENE701(48), 713(16), 714(16), 715(16), 716(16).
Electives: 16C from: BIOL724(16), 733(16), GENE718(16), approved by the School.
b. Westville
Core: GENE701(48), 80C from [BIOC715(16) or MICR701(16)], GENE715(16), [GENE703(16) or BIOL715(16)], GENE716(16), GENE719(16), GENE751(16), GENE752(16).

13. Geology (Westville)
Prerequisites: Completion of a major or programme in Geology. Limitations on student numbers may be imposed by available resources.
Core: GEOL706(16), 707(32) and, depending on the specialisation, either GEOL705(16) or GEOL711(16).
Electives: 80C from GEOL701(16), 702(16), 703(16), 705(16), 708(16), 710(16), 711(16), 712(16), 713(16), 714(16), 715(16), 716(16), 717(16) or up to 16C of electives at Level 7 from related disciplines as approved by the School.

14. Grassland Science (Pietermaritzburg)
This Programme will not be offered in 2020.
*Pre-requisite***:** Major in Biology, Ecology or Environmental Science.
Core: BIOL722(16), BIOL723(16), ENVS700(16), ENVS730(48).
Electives: 32C from AGPS710(16), AGPS715(16), BIOL726(16), Level-7 Elective(16).

15. Horticultural Science (Pietermaritzburg)
Prerequisites: Completion of the BSc programme in Crop and Horticultural Sciences or an appropriate major.
Core: AGPS701(8), 732(16), 790(32), 791(8).
Electives: 64C from AGPS712(16), 716(16), 733(16), 734(16) or up to 16C of other Level-7 or 8 modules may be selected and approved by the School.

16. Hydrology (Pietermaritzburg)
Prerequisites: Completion of a major or programme in Hydrology. *Core*: HYDR710(16), 720(16), 725(16), 730(48), 795(32).

17. Marine Biology (Westville)

Prerequisites: Completion of a major or programme in Biological Sciences.. Note that acceptance into the programme may depend on availability of places.
Core: BIOL701(16), 782(16), 784(16), 791(48), 702 (16).
Electives: 16C from BIOL715(16), 735(16), ENVS720(16).

18. Mathematics (Pietermaritzburg, Westville)

Prerequisites: Completion of a major or programme in Mathematics.
a. Pietermaritzburg
Core: MATH710(16), 721(16), 751(16), 799(32).
Electives: 48C from MATH730(16), 740(16), 762(16), 763(16) or other modules from Statistics, Applied Mathematics or Computer Science, approved by the School.
b. Westville
Core: MATH701(16), 785(16), 799(32).
Electives: 64C from Level-7 MATH. (Up to 32 of these credits may be replaced by Level-7 credits outside the School, approved by the School.)

19. Microbiology (Pietermaritzburg, Westville)

Prerequisites: Completion of a major or programme in Microbiology. **a.**
Pietermaritzburg
Core: MICR710(48), 721(16), 722(16), 723(16), 724(16).
Electives: 16C chosen at Level 7 or 8 approved by the School. **b.**
Westville
Core: MICR701(16), 710(48), 711(16), 713(16), 719(16).
Electives: 16C from BIOL715, GENE703, MICR712.

20. Physics (Pietermaritzburg, Westville)
a. Pietermaritzburg
Prerequisites: Completion of a major or programme in Physics.
Core: PHYS735(32), 741(16), 791(16), 792(16).
Electives: PHYS721(16), PHYS752(32), or up to 32C of modules from within the School or from another school, approved by the School.
b. Westville
Prerequisites: Completion of a major or programme in Physics.
Core: PHYS701(16), 702(16), 703(16), 735(32), 736(16).
Electives: 32C chosen from PHYS737(16), 738(16), 739(16).

Up to 32C of the above Electives may be replaced by modules from another school, subject to the approval by both Schools.

c. Westville (NASSP specialisation)

Prerequisites: Completion of a major or programme in Physics.

Core: PHYS701(16), 724(16), 735(32), 736(16); MATH732(16).

Electives: 32C chosen from PHYS722(16), 723(16), 725(16), MATH703(16).

Up to 32C of the above Electives may be replaced by modules from another programme within the School or another School, subject to the approval by both Schools and NASSP.

21. Plant Pathology (Pietermaritzburg)

Prerequisites: Completion of a major or programme in Plant Pathology.

Core: PPTH730(16), 745(16), 750(48), 715(16).

Electives: PPTH713(16) or 723(16) plus 16 other credits approved by the School.

22. Soil Science (Pietermaritzburg)

Prerequisites: Completion of a major or programme in Soil Science.

Core: SSCI730(16), 750(16), 792(16), 793(48).

Electives: 32C at Level 7 or 8 approved by the School.

23. Statistics (Pietermaritzburg, Westville)

Prerequisites: Completion of a major or programme in Statistics.

a. Pietermaritzburg

Core: STAT714(16), 730(16), 740(16), 795(32).

Electives: 48C from STAT710(16), 711(16), 719(16), 723(16), 733(16), 743(16), 752(16), 753(16), 754(16), or up to 32C approved by School.

b. Westville *Core*: STAT795(32).

Electives: 96C from STAT711(16), 712(16), 713(16), 714(16), 716(16), 717(16), 718(16), 719(16), 721(16), 723 (16), 733(16), 741(16), 743(16), 751(16) or up to 32C from another discipline approved by the School.

Degree of Bachelor of Agriculture (Honours)

AES-H6 Bachelor of Agriculture (Honours) Curriculum

The modules prescribed for the qualification are listed below (128C) (numbers in parentheses refer to credits).

Year-long Modules	
RRMG700 Systems Thinking Foundations	(16)
RRMG710 Rural Development Placement	(32)
RRMG722 Advanced Extension Theory and Practice	(16)
RRMG712 Project Design & Management	(16)
RRMG730 Rural Development/Extension Research Project	(48)

Degree of Bachelor of Agricultural Management (Honours)

AES-H7 Bachelor of Agricultural Management (Honours) Curriculum

The curriculum shall consist of one of the following combinations of modules (128C) (numbers in parentheses refer to credits):

(a) **Commerce Stream**: AGEC740(16), 750(16), AMAN790(32), together with 64 credits at Level 7 approved by the School, of which 48 must be chosen from the School of Management IT and Governance; or

(b) **Production Stream**: AGEC740(16), 750(16), AMAN790(32), (AGPS790(32) or ANSI792(48)), together with 32 credits at Level 7 approved by the School if AGPS790 is chosen, or together with 16 credits at Level 7 approved by the School if ANSI792 is chosen.

Degree of Bachelor of Science in Property Development Honours (Construction Management)

AES-H8Curriculum

Candidates shall complete approved modules to a value of not less than 128 credits and shall comply with the prescribed curriculum requirements:

Semester 1		Semester 2	
ENCS7PA Project Administration	(16)	ENCS7RR Research Report	(32)
ENCS7PF Advanced Project Measurement and Finance	(16)	ENCS7CM Applied Construction Management	(32)
ENCS7RM Research Methodology	(16)		
ENCS7CT Advanced Construction Technology	(16)		

Degree of Bachelor of Science in Property Development Honours (Quantity Surveying)

AES-H9 Curriculum

Candidates shall complete approved modules to a value of not less than 128 credits and shall comply with the prescribed curriculum requirements:

Semester 1		Semester 2	
ENCS7CE Cost Engineering	(16)	ENCS7RR Research Report	(32)
ENPD7RM Research Methodology	(16)	ENCS7SO Simulated Office Project	(32)
ENCS7CT Advanced Construction Technology	(16)		
ENCS7PF Advanced Project Measurement and Finance	(16)		
Total compulsory credits per semester = 64			

POSTGRADUATE DIPLOMAS

Postgraduate Diploma in Community Nutrition

AES-PCN1 Eligibility

An applicant is eligible to apply for selection to register for the qualification of Postgraduate in Community Nutrition provided he or she is

(a) a holder of a Bachelor of Science in Human Nutrition or a graduate of another recognized university who has been admitted to the status thereof; or

(b) a person admitted by permission of the Senate under General Academic Rule GR7(b) to register for the Diploma.

(c) Students shall submit a certificate of registration with the Health Professions Council of South Africa (HPCSA) when applying for admission into the Postgraduate Diploma in Community Nutrition.
(d) Students shall produce a certificate of completed Hepatitis B Immunisations.

AES-PCN2 Repeating of Failed Modules
Except for the project module NUTR741, which may not be repeated, a student may repeat any failed module. No module may be repeated more than once.

AES-PCN3 Curriculum
The modules prescribed for the Diploma are listed below (152C) (numbers in parentheses refer to credits).
Core modules: NUTR711(48), 730(8), 741(32), PODS701(32).
Elective modules: 32C from FDSC700(16), 720(8), 730(8), 755(8), RRMG700(16).

Postgraduate Diploma in Food Security

AES-PFS1 Eligibility
An applicant is eligible to apply for selection to register for the qualification of Postgraduate Diploma in Food Security provided he or she is
(a) a holder of a relevant Bachelors Degree of the University or a graduate of another recognized university who has been admitted to the status thereof; or
(b) a person who has been admitted by permission of the Senate in terms of General Academic Rule GR7(b) as a candidate for the diploma.
(c) The relevance of the qualifications offered shall be determined by the School.

AES-PFS2 Repeating of Failed Modules
Except for the project modules FDSC701 and FDSC711, which may not be repeated, a student may repeat any failed module. No module may be repeated more than once.

AES-PFS3 Curriculum
The modules prescribed for the Diploma are listed below (128C) (numbers in parentheses refer to credits).
Core Modules: FDSC700(16), FDSC760(8), (FDSC701(40) or 711(40)), PODS701(32), RRMG712(16).
Electives: 16C from FDSC720(8), 730(8), 755(8).
 MASTERS DEGREES

MASTERS DEGREES
College Rules for Masters Degrees

AES-M1 Applicability of Rules

This section refers to the following qualifications:

Master of Science	MSc
Master of Science in Agriculture	MScAgric
Master of Science in Engineering	MScEng
Master of Science in Land Surveying	MScSur
Master of Agricultural Management	MAgricMgt
Master of Agriculture	MAgric
Master of Science in Dietetics	MScDiet
Master of Science in Human Nutrition	MScHumNutr
Master of Science in Construction Management	MScConstMan
Master of Science in Quantity Surveying	MScQS
Master of Science in Engineering (Waster & Resource Management)	MSc-WR

AES-M2 Masters Eligibility

(a) Under the provisions of General Academic Rules CR2(b) and MR2(b), except with the permission of the College Dean of Research, applicants must have a credit weighted average of at least 60% in the relevant qualification.

(b) Additional requirements are listed under the rules for specific qualifications.

See also General Rules CR2 and MR2.

AES-M3 Relevant Qualifications

The table below gives the relevant qualification for entry in terms of Rule AES-M2(a) for each qualification.

MSc	Honours degree in an appropriate subject
MScAgric	Bachelor of Science in Agriculture
MScEng	BScEng in an appropriate discipline
MScSur	4-year Bachelors degree in Land Surveying
MAgricMgmt	BAgricMgmtHons
MAgric	BAgric(Hons) or Postgraduate Diploma in Agriculture or Food Security
MScDiet	PGDipDiet (See also Rule AES-M9)

MScHumNutr	PGDipHumNutr (See also Rule AES-M9)
MEnvMan	BScHons in Environmental Science or other appropriate honours degree
MScConstMan	BScPropDevHons(CM)
MScQS	BScPropDevHons(QS)
MSc-WR	BScEng, BScHons, BCom(Hons), BArch(Hons), BA(Hons) in appriate discipline.

Where necessary, the appropriateness of the qualification will be determined by the relevant School.

AES-M4 Types of Masters Degrees

A Masters Degree in the College may be obtained by one of two methods.

1. *By research*. In this case the qualification is assessed purely on the basis of a dissertation.
2. *By coursework*. In this case the qualification is assessed by coursework and a dissertation.

The table below shows which types of Masters Degree may be obtained for each qualification.

MSc	Research or Coursework
MScAgric	Research or Coursework
MScEng	Research
MScSur	Research
MAgricMgmt	Research
MAgric	Research or Coursework
MScDiet	Research
MScHumNutr	Research
MScConstMan	Research
MScQS	Research

Additional Rules for Specific Masters Degrees

AES-M5 Combinations for MSc by Coursework
The following lists give the programmes of study within the degree of Master of Science by coursework. Numbers in parentheses refer to credits.

1. **Environmental Science (Westville)** *Core*: ENVS820(96).
   Electives: A minimum of 64C at Level 8 from ENVS810(16), 813(16), 814(16), 815(16), 817(16). Up to 32C credits chosen from the School.

2. **Mathematics (Westville)**
   Core: MATH811(16), MATH812(16), MATH813(16), MATH814(16), MATH819(96) *Electives*: 32C from MATH815(16), MATH816(16), MATH817(16), MATH818(16).

3. **Water Resources Management (Pietermaritzburg)**
   Core: ENVS810(16), ENVS817(16), ENVS820(96), HYDR820(16), HYDR825(16) *Electives*: 32C as approved by the Programme Co-ordinator.

AES-M7 Combinations for MScAgric by Coursework
The following lists give the programmes of study within the degree of Master of Science in Agriculture by Coursework. Numbers in parentheses refer to credits.

Agricultural and Environmental Instrumentation (Pietermaritzburg):   *Core*: AMET800(96).
 Electives: 96C from AMET860(8), 861(8), 862(8), 863(8), 864(8), 865(8), 866(8), 867(8), 870(16), 871(16) or other modules approved by the School.

AES-M8 Combinations for MAgric
The following lists give the programmes of study within the degree of Master of Agriculture.

1. **Agricultural Extension and Rural Resource Management.** This programme is by research.

2. **Food Security**
   FDSC800(16), 815(96), 840(16), 860(16), 870(16), 880(16), 890(16).

AES-M9 MScDiet and MScHumNutr Additional Requirements
In addition to the requirements of AES-M2 students must have obtained their Postgraduate Diploma having passed all modules on the first attempt with a credit weighted average of 60%, inclusive of a minimum module mark of 60% in NUTR741.

AES-M10 Combinations for MScEng by Coursework
The following lists give the programmes of study within the degree of Master of Science in Engineering by Coursework. Numbers in parentheses refer to credits.
Waste and Resource Management (Howard College):
Core Modules: ENCV (96C); ENCV8RM (16C); ENCV8MS (16C); ENCV8WR (16C); ENCV8ES (16C); ENCV8EI (8C)
Elective Modules: ENCV8WM (8C); ENCV8LD (16C); ENCV8OW (8C); ENCV8IW (8C); ENCV8WL (8C); ENCV8WT (16C). Students have to pass 24 credits from the list of electives above (not previously passed).

AES-M11 MScEng by Coursework Additional Requirements
Recognition of Prior Learning will be applied only for a BTech Eng.
Applicants with a BTech Eng (Civil, Environmental, Resource and Bioresource Eng., Agriculture, Chemical, Industrial, Mechanical, Mining) could also be considered under Rule GR7b but need to have a class of pass in their degree of >70% and at least 5 years of relevant experience at the level of Design Engineer. In accordance with the UKZN Decision Flow Diagram/Guidelines admission of GR7b applicants must be motivated by the Programme Coordinator to Dean and Head of School or Academic Leader Research and Higher Degree who will recommend to College Dean of Research for final admission.

DOCTORAL DEGREES

Degree of Doctor of Philosophy

AES-D1 PhD Eligibility Requirements

Under General Academic Rule, DR2, the relevant pre-requisite qualification is an appropriate Master's degree in one of the disciplines in this College.

AES-D2 Upgrading

Candidates registered for a research masters degree in the College who have produced research results deemed to be suitable for upgrade to a PhD degree may apply (under GR7(b)) to have their registration upgraded to a Doctor of Philosophy registration before the masters is awarded. The total minimum registration for the PhD shall be not less than six semesters after admission to the status of Honours or after completion of a four year degree. Registration may not subsequently revert to masters.

Degree of Doctor of Science
and
Degree of Doctor of Science in Agriculture

AES-SD1 Eligibility

An applicant is eligible to apply for selection to register for the senior doctoral qualifications in this College under General Academic Rule DS2. The relevant doctoral degree is in a discipline offered by the College.

Introduction to the Syllabus Section

How to Understand a Syllabus

In order to understand the syllabus section that follows, consider the following example:

Electromagnetism, Waves and Modern Physics
PHYS120 P2 W2   (39L-9T-36P-0S-54H-15R-0F-0G-7A-13W-16C)
Prerequisite requirements: 40% in PHYS110 or PHYS113 or 60% in PHYS131.
Corequisite: MATH140.
Aim: Introduction to electromagnetism, waves, physical optics and modern physics.
Content: Electricity and Magnetism: charge, Coulomb's law, electric field, Gauss' law, electric potential, capacitance, resistance, Ohm's law, dc circuits, Kirchhoff's rules, ammeters, voltmeters, Ampère's law, Faraday's law, inductance. Waves: transverse, longitudinal, travelling, standing, beats, Doppler effect. Physical Optics: interference, diffraction, polarisation. Modern physics: photoelectric effect, Bohr model of hydrogen atom, nucleus, radiation.
Assessment: Class tests (25%), practical reports (5%); 3 h theory exam (50%), 2 h practical exam (20%). **DP Requirement:** Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals
Credit may not be obtained for both PHYS120 or PHYS114 and PHYS196.

The **title** is **Electromagnetism, Waves and Modern Physics**
The code **PHYS120 or PHYS114 P2 W2** shows that the syllabus is in Physics ("PHYS") and that it is at Level 1. The 2 & 0 have no special significance. P2 and W2 show that it is offered in semester 2 at Pietermaritzburg and Westville. Similarly H1 would show it is offered in semester 1 in Howard College and W1 at Westville. Other codes are B if the module is offered in both semesters, C if it may be offered in either the first or second semester, Y if it is a year-long module, and V if it is offered in the winter vacation. Thus, for example, GEOL304 WV is a Westville module in Geology in 3rd year during the winter vacation.

The **notional study hours**
                              (39L-9T-36P-0S-54H-15R-0F-0G-7A-13W-16C)
are interpreted as follows:

39L means 39 hours of lectures, i.e. 52 lectures of 45 minutes
9T means 9 hours of tutorials   36P means 36 hours of practicals
0S means 0 hours of seminars   54H means 54 hours of self-study
15R means 15 hours of revision 0F means 0 hours of field attachments 0G means 0 hours for problem based groups 7A means 7 hours of assessment (formal tests and exams)
13W means the module runs for 13 weeks 16C means the module is worth 16 credits.

The meanings of "prerequisite", "corequisite" and "DP requirements" are explained in the definitions at the beginning of the handbook. It is assumed that no explanation is needed for "aims", "content" etc.

SYLLABI

Agribusiness

Offered in the School of Agricultural, Earth and Environmental Sciences

Agribusiness Research Project & Seminar
AGBU791 PY   0L-20T-0P-20S-280H-0R-0F-0G-0A-26W-32C)
Corequisite: AGEC740 and (ANSI711 or AGPS791 or (BIOL722 and BIOL723)).
Aim: To equip students with the ability to: (a) critically review literature, write scientific papers, and formally present and defend their work, and (b) integrate theory and techniques covered in earlier modules.
Content: This module integrates topics covered in earlier modules. For the project, students must identify a relevant research problem, develop models to test hypotheses, collect and analyse data, interpret results, recommend how to solve the problem, and prepare a comprehensive research report.
Assessment: Presentation of 1 paper (33%), research report (67%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam. Only for students in Agribusiness.

Agricultural Economics

Offered in the School of Agricultural, Earth and Environmental Sciences

Introduction to Agricultural Economics
AGEC210 P1   (39L-0T-39P-0S-56H-20R-0F-0G-6A-13W-16C)
Aim: (a) To understand the key economic principles of production, market demand and supply and how these principles can assist farm decision-makers in making improved decisions, and (b) to learn key accounting principles to develop a sound farm record-keeping system.
Content: Market demand for agricultural products. Market supply of agricultural products. Price movements. The firm (farm) as a decision-making unit. Production functions of the farm business. Determining the optimum level of production. Farm costs of production. Agricultural input substitution. Decisions on the choice of agricultural products.
Practicals: Elementary farm accounting.
Assessment: 2 class tests (33%); 3 h exam (67%).
DP Requirement: 40% average for the 2 class tests, and attendance at 80% of all practicals.
Subminimum to pass: 40% in (exam/assessment)

Farm Management
AGEC220 P1   (39L-0T-39P-0S-57H-20R-0F-0G-5A-13W-16C)
Corequisite: AGEC210 or ECON101 or ECON102
Aim: To understand the economic and management principles which guide the practice of managing farms.
Content: Farm management - definition, planning environment, managerial functions and management by objectives. Key economic principles and planning concepts. Farm information systems, data analysis and budgeting. Organisation of capital. Farm machinery management. Land economics. Labour management.
Practicals: Application of economic principles to farming, analysis of farm records, budgeting, capital use and machinery and labour management decisions.
Assessment: 2 class tests (33%); 3 h exam (67%).
DP Requirement: 40% average for the 2 class tests, and attendance at 80% of all practicals.
Subminimum to pass: 40% in (exam/assessment)

Applied Farm Financial Management

AGEC240 P2 (20L-0T-39P-0S-8H-10R-0F-0G-3A-13W-8C)

Prerequisite Modules: AGEC220 (Agricultural Engineering students are exempt).

Aim: To learn and apply the principles and tools of finance to managerial problems in agriculture.

Content: Farm financial management objectives. Information flows in farm financial management. Financial leverage, farm firm growth and liquidity. Risk management in agriculture. Impact of time and risk on managerial decisions. Farm land values. Estate duty and the farmer.

Practicals: Risk analysis, information flows, farm firm growth model, capital budgeting and discounted cash flow problems.

Assessment: Class test (33%); 1.5 h exam (67%).

DP Requirement: 40% for the class test, and attendance at 80% of all practicals.

Credit may not be obtained for both AGEC240 and AGEC270.

Subminimum to pass: 40% in (exam/assessment)

Agribusiness Finance & Marketing

AGEC270 P2 (39L-0T-39P-0S-57H-20R-0F-0G-5A-13W-16C)

Corequisite: AGEC220 or HRMG2HM or MARK2IM or ENTR2IE

Aim: (a) To apply finance principles to solve managerial problems in agriculture, and (b) to study food marketing principles, and to craft and implement strategy in food and agricultural firms.

Content: Financial management objectives and information flows. Financial leverage, farm firm growth and liquidity. Risk management. Impact of time and risk on managerial decisions. Farm land values. Estate duty. Food marketing margins and marketing efficiency. Agricultural and food business strategy. Marketing alternatives.

Practicals: Risk analysis, information flows, farm firm growth model, capital budgeting and discounted cash flow problems, and agribusiness case studies.

Assessment: 2 class tests (33%); 3 h exam (67%).

DP Requirement: 40% average for the 2 class tests, and attendance at 80% of all practicals.

Credit may not be obtained for both AGEC240 and AGEC270.

Subminimum to pass: 40% in (exam/assessment)

Production Economics & Price Analysis

AGEC370 P2 (39L-0T-39P-0S-57H-20R-0F-0G-5A-13W-16C)

Corequisite: AGEC270 or FINA202 or 16C in Level-2 ECON.

Aim: To apply principles of production economics in making enterprise choices, to quantify demand & supply relations in agriculture, and assess the economic effects of policies that distort markets.

Content: Empirical farm-level production functions. Cost minimising & profit maximising criteria. Linear programming. Farm planning under risk. Market demand & supply functions in agriculture. Relationships between price, income & cross-price elasticities. Import tariffs & export subsidies. Econometric and non-econometric price analysis.

Practicals: Application of production and cost functions to agriculture. Farm planning with linear programming. Regression analysis of demand functions.

Assessment: 2 class tests (33%); 3 h exam (67%).

DP Requirement: 40% average for the 2 class tests.

Subminimum to pass: 40% in (exam/assessment)

Agricultural Development

AGEC380 P1 (39L-6T-8P-0S-82H-20R-0F-0G-5A-13W-16C)

Corequisite: AGEC220 or 32C in Level-2 ECON.

Aim: (a) To identify constraints which limit agricultural and economic growth in less-developed regions, and (b) to analyse policies that will alleviate these binding constraints.

Content: Characteristics of developing regions. Role of agriculture in economic development. Theories of economic and agricultural growth. Adoption of technology. Impact of property rights (land tenure), credit, risk and information on technology adoption. Demand for children.

Practicals: 1 field trip.
Assessment: 2 class tests (33%); 3 h exam (67%).
DP Requirement: 40% average for the 2 class tests.
Subminimum to pass: 40% in (exam/assessment)

Agricultural Policy Analysis
AGEC740 P2   (39L-13T-0P-0S-83H-20R-0F-0G-5A-13W-16C)
Prerequisite Modules: AGEC370.
Aim: To provide insight into the application of economic theory to a wide range of policy issues in South African agriculture. This module contributes towards an understanding of the macro-economic situation facing South African agriculture.
Content: Private versus collective choice. Product and resource market policies. Product and resource demand. Trade issues. Farmland use and value. Environmental and natural resources policy issues. Cost benefit Analysis.
Assessment: 2 class tests (33%); 3 h exam (67%).
DP Requirement: 40% average for the 2 class tests.

Research Methodology & Linear Programming
AGEC750 P1   (39L-5T-39P-0S-32H-20R-0F-0G-25A-13W-16C)
Prerequisite Modules: AGEC370.
Aim: To equip students with research and Linear Programming methodology relevant to agricultural economics, agribusiness and farm management.
Content: Defining the research problem and developing the research proposal; report writing. Methods of data collection, questionnaire design and data analysis. LP models for farm planning. MOTAD and game theory models for income risk. Multi-period models for cash flow analysis. Mixed integer programming models for plant selection. Transport and trans-shipment models. Least cost ration and forage planning models. Data envelopment analysis.
Assessment: Two class tests (20%), project proposal (15%), Linear Programming project (15%); 3 h exam (50%).
DP Requirement: 40% class mark.

Management Research Project & Seminar
AGEC791 PY   (0L-20T-0P-20S-280H-0R-0F-0G-0A-26W-32C)
Aim: To equip students with the ability and confidence to: (a) critically review literature, write scientific papers, and formally present and defend their work; and (b) integrate theory and techniques covered in earlier modules.
Content: This module integrates topics covered in earlier modules. For the project, students must identify a relevant research problem, develop models to test hypotheses, collect and analyse data, interpret results, recommend how to solve the problem, and prepare a comprehensive research report.
Assessment: Presentation of 1 paper (33%), research report (67%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam. Only for students majoring in Agricultural Economics.

Advanced Agricultural Price Analysis
AGEC802 P1   (20L-0T-0P-0S-30H-27R-0F-0G-3A-13W-8C)
Aim: To provide insight into the application and analysis of price theory in product and resource markets with specific reference to South African Agriculture. This module focuses on macro-economic issues.
Content: Economics of free markets (Hayek, Buchanan, and Coase). Economics of water markets. Supply and risk. Demand for resources. Agriculture and the State.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance at lectures.
Only for students registered for MScAgric in Agricultural Economics or Agribusiness, or MAgricMgmt or MSc in Agricultural Economics.

Applied Econometrics
AGEC803 P1   (0L-39T-39P-0S-43H-36R-0F-0G-3A-13W-16C)
Aim: To enable students to apply econometric models and techniques to a wide range of empirical problems in the fields of economic policy, price analysis, marketing, and agribusiness management.
Content: Methodology of Econometrics. Multicollinearity, autocorrelation and specification bias in linear regression models. Dummy variables. Lag and autoregressive models. Panel data regression models. Simultaneous-equation models. Cointegration. Principal components. Linear discriminant, logit and probit models. Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized ARCH (GARCH) models.
Practicals: Computer applications in practical exercises using selected econometric data.
Assessment: 1 project (30%); 1 class test (20%); 3 h exam (50%).
DP Requirement: 50% for the 1 project.
Only for students registered for MScAgric in Agricultural Economics or Agribusiness, MSc in Agricultural Economics, MAgricMgmt or MCom in Economics.

Strategic Farm & Agribusiness Management
AGEC804 P1   (0L-20T-0P-0S-30H-27R-0F-0G-3A-13W-8C)
Aim: To provide students with a thorough insight into the key issues facing farm and agribusiness managers. This module focuses on micro-economic, macro-economic and strategy issues.
Content: Strategy crafting. Competitive strategy and competitive advantage in diversified and non-diversified firms. Global strategies. Competing in foreign markets. Strategy implementation. Agribusiness case studies. Key farm and agribusiness issues (economics and management of resources, risk, inflation, information, value innovation, HIV/AIDS, ethics and empowerment).
Assessment: One agribusiness case study oral and written presentation (30%); 3 h exam (70%).
DP Requirement: 50% for the agribusiness case study presentation.
Only for students registered in MScAgric in Agricultural Economics or Agribusiness, or MAgricMgmt or MSc in Agricultural Economics.

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Agricultural Engineering for Agriculture
Offered in the School of Engineering (See also ENAG)

Agricultural Mechanisation
AGEN216 P1   (20L-7T-7P-0S-30H-12R-0F-0G-4A-13W-8C)
Aim: To provide students with knowledge of the principles of operation and management of agricultural machines and their application.
Content: Farm power: spark ignition and compression ignition, internal combustion engines; power transmission; tractors, traction and tractor operation. Agricultural machinery: implements and machines; principles of operation, adjustment and use. Farm power and machinery management: power, machinery performance; cost analysis; mechanisation planning and equipment selection.
Practicals: Engines, fuel injection, power train, ploughing, implements and planning.
Assessment: 2 tests (20%), pracs/research project (10%), 1 tutorial (5%); 2h exam (65%).
DP Requirement: Students are required to write all class tests and complete all practicals and assignments satisfactorily, as specified in the module outline.

Soil & Water Conservation Systems
AGEN225 P2   (40L-10T-18P-0S-68H-20R-0F-0G-5A-13W-16C)
Aim: To provide students with an understanding of the principles of soil and water conservation and their application.
Content: Conservation principles and processes; Water flow, erosion, land degradation and rehabilitation. Surveying and positioning systems: Tachiometry, contours, GPS systems. Design of soil and water conservation systems: Agricultural field layout, reclamation of a degraded area.

Practicals: Survey and field trip for assessing erosion prevention devices and degraded land areas.

Assessment: Exam (70%), 2 tests and design projects (30%)

DP Requirement: Students are required to write all class tests and complete all practicals and assignments satisfactorily, as specified in the module outline

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Agricultural Plant Sciences

Offered in the School of Agricultural, Earth and Environmental Sciences

Introduction to Plant Production

AGPS200 P2   (39L-0T-43P-0S-60H-14R-0F-0G-4A-13W-16C)

Prerequisite Modules: BIOL101.

Aim: To provide knowledge of the principles of agricultural plant production locally and globally.

Content: Origins of agriculture. Crop establishment from seed and vegetative material. Crop classification. Plant nutrition, plant morphology and development. Carbon and nitrogen metabolism. Principles of plant breeding, agricultural development.

Practicals: Once a week on topical subject. Practicals may include field trips.

Assessment: 2 tests (25%), laboratory reports (12.5%), project (12.5%); 2 h exam (50%).

DP Requirement: 40% Class mark, attendance at 80% of practicals & 100% of tests.

Grassland Science

AGPS230 P2   (36L-0T-46P-0S-58H-16R-0F-0G-20A-13W-16C)

Prerequisite Modules: BIOL102.

Corequisite: STAT130.

Aim: To provide an understanding of the evolution of grasses & to provide the skills needed to identify the common rangeland & commercial grasses & their environmental context.

Content: This module compliments the existing Biology modules in, to focus specifically on grasses and introducing the commercial value of grasses as well as their use, characteristics and propagation.

Practicals: Identification and environmental context of the common grass species and their cultivation. May include a weekend field trip.

Assessment: Assignments (including collection of grass species) (15%), tests (15%), practical test (10%), essay (10%); 3 h exam (50%).

DP Requirement: 40% Class mark, 80% attendance at practicals; 100% attendance at tests.

Irrigation Design & Management

AGPS301 P1   (36L-6T-45.5P-0S-44H-24R-0F-0G-4.5A-13W-16C)

Aim: To introduce students to the principles of irrigation design and management.

Content: Criteria for selection of land and water for irrigation; availability of soil water; measurement of soil water; water uptake; crop water requirements and response to water stress; design of irrigation systems; pumps and flow of water in pipes and channels; irrigation scheduling; negative impacts of irrigation on soil and water resources.

Practicals: Field excursions; designing an irrigation scheme with associated management recommendations; tutorial exercises on irrigation.

Assessment: 2 theory tests (7%), irrigation design report (35%), tutorials (8%); 3 h exam (50%).

DP Requirement: 40% Class mark, attendance at 80% of practicals & 100% of tests.

Credit may not be obtained for both AGPS301 and HYDR313.

Field Crop Management

AGPS305 P1   (38L-0T-43P-0S-60H-14R-0F-0G-5A-13W-16C)

Prerequisite Modules: AGPS200.

Aim: To provide students with knowledge of management practices involved in the production of field crops.

Content: Soil fertilization and liming, tillage and residue management, mulching, crop improvement techniques, weed and pest control, ley-cropping, forage preservation and grain storage.
Practicals: Research project with field trips.
Assessment: 2 tests (25%), research project (15%), prac report (10%); 3 h exam (50%).
DP Requirement: None

Principles of Plant Breeding
AGPS306 P2   (36L-3T-27P-12S-47H-30R-0F-0G-5A-13W-16C)
Prerequisite Modules: AGPS200; GENE240.
Aim: To provide students with an understanding of principles and practical skills in classical plant breeding.
Content: Sexual and asexual modes of reproduction; quantitative or polygene inheritance; fertility-regulation; breeding self-pollinated, cross-pollinated, hybrids and clonally propagated plants; utilization of polyploidy and induced mutations.
Practicals: Conducting hand-pollinations of selected plant species, data collection and statistical analysis, and selections from segregating populations.
Assessment: 2 tests (24%), 1 mini-seminar presented in both written & verbal form (12%), 1 prac report (14%); 3 h exam (50%).
DP Requirement: 40% Class mark, attendance at 80% of practicals & 100% of tests.

Orchard Management
AGPS307 P1   (38L-0T-43P-0S-60H-14R-0F-0G-5A-13W-16C)
Aim: To provide students with skills and experience in managing intensively produced orchard crops.
Content: Climate and climate modification, modification of the plant environment, managing orchard soils and the orchard floor, plant factors in the orchard, plant manipulation, crop protection, harvesting and postharvest handling.
Practicals: Field trips to commercial orchards, as well as at the University research farm.
Assessment: 2 theory tests (25%), prac assessment (25%); 3 h exam (50%).
DP Requirement: 40% Class mark, attendance at 80% of practicals & 100% of tests.

Crop Protection
AGPS308 P2   (39L-0T-36P-0S-60H-20R-0F-0G-5A-13W-16C)
Prerequisite Modules: BIOL101, 102.
Aim: To introduce students to the principles of integrated control of crop pests, diseases and weeds.
Content: Principles of integrated pest control, ecological interaction, management and use of threshold level of pests, diseases and weeds; pesticide formulation; sprayer calibration and nozzle function. Safe handling and storage of pesticides.
Practicals: Pest and disease recognition, weed identification, scouting; disease and weed assessment; field evaluation of herbicides and phytotoxicity; calibration of applicators. Disease control project. Field visits.
Assessment: 2 tests (25%), practicals and projects (25%); 3 h exam 50%.
DP Requirement: 40% Class mark, attendance at 80% of practicals & 100% of tests.

Protected Cultivation of Plants
AGPS309 P1   (36L-0T-43P-0S-60H-16R-0F-0G-5A-13W-16C)
Prerequisite Modules: BIOL101.
Aim: To provide students with an understanding of the influence of environmental conditions on development and growth of crops and the optimisation of these conditions in protected environments.
Content: The influence of environment on plant growth and development, greenhouse structures and covering materials, shadehouses, growth rooms, nurseries, artificial lighting and daylength control, climate control, irrigation and growing systems, with special emphasis on hydroponic production, growing media, plant production with emphasis on propagation.
Practicals: Visits to commercial enterprises, plant propagation practicals, plant production practicals.
Assessment: 2 theory tests (25%), assignments (25%), 3h exam (50%).
DP Requirement: 40% Class mark, attendance at 80% of practicals & 100% of tests.

Biotechnology in Crop Improvement

AGPS311 P1   (36L-3T-39P-6S-40H-20R-0F-10G-6A-13W-16C)

Prerequisite Modules: GENE240.

Aim: To enhance the knowledge base, skills and competencies of students in integrating biotechnology tools in crop improvement programmes.

Content: Scope and impact of molecular plant breeding. Molecular markers. Types of mapping populations. Molecular breeding tools, marker assisted breeding (MAB); examples of genetic engineering in plant breeding; review of biotechnology regarding policy, economic, social, and environmental issues and food security requirements. Critical analysis of cost and benefits of taking a classical versus biotechnology approach in plant breeding. Integration of biotechnology tools in a plant breeding.

Practicals: Sampling and processing of plant tissues for laboratory genotyping. Marker-assisted breeding and genetic engineering in crop improvement. Biotechnology tools.

Assessment: Practical (10%), Case study (15%), Test (10%), Field Report (15%); 3 h exam (50%).

DP Requirement: 40% class mark. Attendance at 80% of practicals and all tests.

Agricultural Plant Physiology

AGPS320 P2   (38L-0T-36P-0S-51H-30R-0F-0G-5A-13W-16C)

Prerequisite Modules: CHEM110, 120.

Corequisite: BIOC201 or 212.

Aim: To develop skills required for analysis of mechanisms controlling and coordinating plant growth and development.

Content: Physiological processes related to plant mineral nutrition, photosynthesis in agriculture, source-sink relationships, fruit growth and development pre- and post-harvest.

Practicals: To demonstrate the above mentioned processes.

Assessment: 2 tests (10%), 1 essay (20%), prac assignments (20%); 3 h exam (50%).

DP Requirement: 40% Class mark, attendance at 80% of practicals & 100% of tests.

Principles of Agricultural Research

AGPS701 P1   (18L-6T-9P-0S-34H-10R-0F-0G-3A-13W-8C)

Aim: To acquire the skills to plan, implement, and communicate results of agricultural research.

Content: Presentation of technical information and communication skills; development, organization and financing of agricultural research; research philosophy and policy. Research methods with emphasis on the scientific method and economic plant improvement. Field plot, glasshouse and controlled environment research techniques.

Practicals: Critical reviews of published scientific papers; conduct of field and pot experiments; visits to research establishments.

Assessment: Theory test (20%), oral & written criticisms (30%); 2 h exam (50%).

DP Requirement: 40% Class mark, attendance at 80% of practicals & 100% of tests.

Forage Production & Utilisation

AGPS710 P1   (38L-0T-39P-0S-62H-16R-0F-0G-5A-13W-16C)

Prerequisite Requirement: An academic background deemed suitable by the School.

Aim: To equip students with an understanding of the principles of selection, growth, management and utilization of cultivated forages.

Content: Accumulation and utilization of energy reserves, nitrogen fixation, soil amelioration and fertilization, and uses of forage crops for animal production systems.

Practicals: Demonstrations, visits, exercises and assignments designed to enhance the understanding of the lectures.

Assessment: 2 tests (30%), prac exercises (15%); 3 h exam (55%).

DP Requirement: 40% Class mark, attendance at 80% of practicals & 100% of tests.

Advanced Seed Technology

AGPS712 P2   (36L-0T-37P-0S-65H-15R-0F-0G-7A-13W-16C)

Prerequisite Requirement: AGPS200 or permission of the School.
Aim: To provide skills and experience in seed science and technology.
Content: Physiology, biochemistry and molecular biology of orthodox and recalcitrant seeds in relation to seed production, development, germination, conditioning, storage and marketing.
Practicals: A project pertinent to the objectives of the course will be undertaken by students as individuals or groups. One trip to a seed related institution. One field trip to a farming community.
Assessment: 2 theory tests (30%), 1 practical report (15%), assignment / field trip report (5%); 3 h exam (50%).
DP Requirement: None

Staple Crop Production

AGPS714 P2   (37L-0T-37P-0S-65H-16R-0F-0G-5A-13W-16C)
Aim: To provide an understanding of the crop-environment interaction and its management to sustain staple crop production.
Content: A study of the management and production of staple crops drawn from summer and winter cereals, legumes and roots & tubers. Impact of environmental variables particularly stress on crop production. Management to sustain productivity. Harvesting, grading and storage of crop products.
Practicals: Mini-project/poster presentation. Visits to research stations and crop producers.
Assessment: 2 tests (30%), practicals (15%), assignment / field trip report (5%); 3 h exam (50%).
DP Requirement: None

Industrial Crop Production

AGPS715 P1   (44L-0T-26P-0S-65H-20R-0F-0G-5A-13W-16C)
Aim: Students will, through acquisition of an understanding of the basis of crop growth and development, be able to improve productivity of industrial crops.
Content: A detailed study of agronomy, physiology, nutrition, growth and development in relation to environmental factors of selected industrial food and non-food crops from oils, starch & sugars, fibres & dyes and tobacco. Crop improvement, harvesting storage and grading of crop products.
Practicals: Mini-project/poster presentation. Visits to research stations and crop producers.
Assessment: 2 theory tests (30%), assignment / field trip report (5%), literature review (5%), prac report (10%); 3 h exam (50%).
DP Requirement: None

Pomology

AGPS716 P1   (36L-0T-43P-0S-60H-16R-0F-0G-5A-13W-16C)
Prerequisite Modules: AGPS307.
Aim: To increase understanding of the production of fruit crops, including temperate, tropical and subtropical and citrus fruits.
Content: The origin, distribution, classification of major fruit types. Fruit and tree morphology. Techniques for manipulation of production.
Practicals: Field trips to production units of the major fruit crops.
Assessment: 2 tests (20%), self-study assignments (30%); 3 h exam (50%).
DP Requirement: 40% Class mark, 80% attendance at practicals and 100% attendance at tests.

Advanced Plant Breeding

AGPS730 P2   (36L-0T-33P-0S-56H-30R-0F-0G-5A-13W-16C)
Prerequisite Modules: GENE310, 715; STAT130, 222.
Aim: To expose students to advanced concepts in applied plant breeding.
Content: Critical analysis and vigorous debate of topics e.g. interpreting genotype x environment interactions; genetics of host x parasite interactions; gene action; marker assisted selection; ideotype breeding; alternative approaches such as somatic cell hybridization and cell selection.

Practicals: Analysis and discussion of applied problems. A mini-literature review on a selected topic to be presented in both written and verbal form.
Assessment: 2 theory tests (25%), assignment report (15%); 3 h exam (60%).
DP Requirement: 40% Class mark, attendance at 80% of practicals & 100% of tests.

Postharvest Technology
AGPS732 P2   (36L-0T-43P-10S-50H-16R-0F-0G-5A-13W-16C)
Aim: For students to be proficient in postharvest management of horticultural crops.
Content: Pre- and post-harvest physiology of major groups of horticultural products as influenced by environmental conditions and storage atmosphere. Packhouse technologies for decreasing incidence of physiological and pathological disorders. Technology for quality prediction. Effects and requirements of phytosanitary regulations. Quality and food safety management systems, and logistics for distribution of products from farm to consumer.
Practicals: Field trips to packing and distribution units.
Assessment: 2 tests (30%), self-study assignments (20%); 3 h exam (50%).
DP Requirement: 40% Class mark, 80% attendance at practicals and 100% at tests.

Vegetable and Flower Crop Production
AGPS733 P1   (30L-0T-40P-0S-70H-15R-0F-0G-5A-13W-16C)
Prerequisite Modules: AGPS200.
Aim: To familiarize students to the production and utilization of vegetable and floriculture crops.
Content: Key concepts of production of flower and vegetable crops, their classification, management and utilization.
Practicals: Practical projects, visits to commercial enterprises.
Assessment: 2 theory tests (20%), assignments (30%), 3 h exam (50%).
DP Requirement: 40% Class mark, attendance at 80% of practicals & 100% of tests.

Ornamental and Amenity Horticulture
AGPS734 P2   (30L-0T-40P-0S-70H-15R-0F-0G-5A-13W-16C)
Prerequisite Modules: AGPS200.
Aim: To extend student's knowledge into production and utilization of plants in the recreational and leisure industry.
Content: Key concepts of landscape design, plant selection, indigenous alternatives, alien invaders, amenity plants, turf grass species and management, sustainable design and management.
Practicals: Visits to commercial enterprises, practical projects.
Assessment: 2 theory tests (25%), assignments (25%), 3 h exam (50%).
DP Requirement: 40% Class mark, attendance at 80% of practicals & 100% of tests.

Grasses in Rehabilitation and Bio-engineering
AGPS770 PC   (14L-0T-22P-0S-25H-0R-0F-0G-19A-13W-8C)
Prerequisite Modules: BIOL323.
Corequisite: STAT130.
Aim: To provide an understanding of grasses in environmental rehabilitation, and to provide the skills needed to apply the common commercial grasses according to their properties and in the correct environmental context.
Content: Focuses specifically on the use of grasses (both indigenous and exotic) in terms of their commercial value in erosion mitigation and bank stabilisation, as well as their use, characteristics and propagation in industry.
Practicals: The emphasis is on commercial use of the common grass species and their cultivation. May include a weekend field trip.
Assessment: Assignments (30%); test(s) (10%), essay (10%); 2 h exam (50%).
DP Requirement: 40% Class mark, 80% attendance at practicals; 100% attendance at tests.

Applied Plant Sciences Project & Seminar
AGPS790 PY   (10L-0T-0P-30S-280H-0R-0F-0G-0A-26W-32C)

Aim: To develop written and verbal communication skills; critical and creative thinking; information retrieval, evaluation, comprehension and review skills.
Content: Undertake and present a literature review on an approved topic and undertake an appropriate research project.
Practicals: Survey of relevant literature. A research project including design and management, record and analyse data, a written report, Verbal presentations will include use of modern presentation media.
Assessment: Written & verbal presentations are assessed by internal & external examiners. Students may be required to go on a field trip. Seminar (40%), project (60%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam.

Observation & Analysis of Agro-Industry
AGPS791 P2   (0L-0T-64P-16S-0H-0R-0F-0G-0A-2W-8C)
Corequisite: AGPS701 or 790.
Aim: To introduce students to a variety of agro-industries, and integrate theoretical knowledge within the operations within a diverse commercial sector.
Content: Visit agro-industries, including farms, companies, processing plants and research institutions during vacation periods to observe and evaluate production as well as value adding, marketing and distribution of products related to plant based agricultural industries.
Practicals: Site visits to several agricultural enterprises.
Assessment: Seminar comprising written and oral analyses related to the agro-industries that were visited (100%).
DP Requirement: Not applicable.
This module has no supplementary exam.

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Agriculture (General Modules)

Offered in the School of Agricultural, Earth and Environmental Sciences

Farming Systems
AGRI151 P1   (39L-0T-32P-0S-40H-20R-0F-24G-5A-13W-16C)
Aim: To provide an introduction into different farming systems and basic production requirements of crop and animal systems.
Content: Farming systems; types of crops and animals; basic requirements for crop or animal system; terminology and recording; stages in production cycle of crops and animals; productivity and profitability of crop or animal production; production records.
Practicals: 3 Weekly 2 hour practical.
Assessment: Tests, assignments and practical assessments (60%); 3 h exam (40%).
Subminimum to pass: 40% in exam.
DP Requirement: 40% class mark; 80% attendance at lectures and practicals.
Only for students registered at Cedara College of Agriculture.

Agricultural Production
AGRI152 P2   (39L-0T-32P-0S-40H-20R-0F-24G-5A-13W-16C)
Aim: To provide basic insight into crop and animal production principles and how to apply them.
Content: Physiology of Plants and Animals. Basic management principles of basic crop and animal production system. Plant & Animal health. Feeding systems available for livestock production.
Practicals: Weekly 2 hour practical.
Assessment: Tests, assignments and practical assessments (60%); 3 h exam (40%).
Subminimum to pass: 40% in exam.
DP Requirement: 40% class mark; 80% attendance at lectures and practicals.

Only for students registered at Cedara College of Agriculture.

Field Crop Production

AGRI261 P2   (30L-0T-32P-0S-60H-20R-0F-13G-5A-13W-16C)

Prerequisite Modules: AGRI267

Aim: To gain knowledge in field crop production systems and be able to determine the best management practices for a particular farming situation, in order to become an efficient producer.

Content: The industry; data used in managing crop enterprises; crop growing systems; plant and growth characteristics; environmental factors; establishing crops; manipulation of environment; sustainable production; economics; harvesting, packaging and marketing products.

Practicals: Weekly 2 hour practical; scheduled field trips to field crop production farms and markets. In addition to tuition fees, each student will be required to contribute towards the cost of subsistence, accommodation and transport.

Assessment: Tests, assignments and practical assessments (60%); 3 h exam (40%).

Subminimum to pass: 40% in exam.

DP Requirement: 40% class mark; 80% attendance at lectures and practicals.

Only for students registered at Cedara College of Agriculture.

Intensive Livestock Production

AGRI265 P1   (30L-0T-32P-0S-50H-20R-0F-13G-15A-13W-16C)

Prerequisite Modules: AGRI152.

Aim: To gain knowledge in intensive livestock production and be able to determine the best management practices for a particular farming situation, in order to become an efficient producer.

Content: The livestock industry, breeding and selection; management principles and practices; reproduction; feeding and nutrition; growth and development; product quality; value adding; records; economics of production.

Practicals: Weekly 2 hour practical; scheduled field visits to livestock production farms and markets.

Assessment: Tests, assignments and practical assessments (60%); 3 h exam (40%).

Subminimum to pass: 40% in exam.

DP Requirement: 40% class mark; 80% attendance at lectures and practicals.

Forage Livestock Production

AGRI266 P2   (30L-0T-32P-0S-50H-20R-0F-13G-15A-13W-16C)

Prerequisite Modules: AGRI152.

Aim: To gain knowledge in the management of livestock being produced on forage (veld and planted pastures), as well as the management of these forage resources for optimal animal production, forage quality and environmental sustainability.

Content: Veld management; pasture selection and management. Grazing and grazing systems. Conserved feeds. Stock and fodder flow planning. Management of grazing livestock.

Assessment: Tests, assignments and practical assessments (60%); 3 h exam (40%).

Subminimum to pass: 40% in exam.

DP Requirement: 40% class mark; 80% attendance at lectures and practicals.

Plant Propagation

AGRI267 P1   (33L-0T-34P-0S-50H-20R-0F-8G-15A-13W-16C)

Prerequisite Modules: AGRI152.

Aim: To gain knowledge in plant propagation techniques, principles and practices, and be able to determine the best management practices for a particular technique, in order to become an efficient producer.

Content: The industry; propagation environment; breeding systems; sexual propagation and vegetative propagation; cell tissue culture propagation.

Practicals: Weekly 2 hour practical; scheduled field trips to field crop production farms and markets.

Assessment: Tests, assignments and practical assessments (60%); 3 h exam (40%).

Subminimum to pass: 40% in exam.

DP Requirement: 40% class mark; 80% attendance at lectures and practicals.

Scientific Communication
AGRI710 P1   (18L-50T-0P-0S-92H-0R-0F-0G-0A-13W-16C)
Aim: To prepare postgraduate science students with core communication skills in reading, writing and oral presentations for effective and efficient performance in postgraduate (and professional) work.
Content: Planning and conducting a literature review, summarizing, information retrieval; characteristics of well-written, formal scientific writing; constructing an argument; mind maps; the principles and strategies of efficient and effective advanced reading; the professional writing process; common errors in scientific English; oral presentations in science.
Assessment: Library project (15%), summaries (10% x 2), 2 science essays (20% x 2), reading test (5%), oral presentation (20%).
DP Requirement: Not applicable.
To be offered only in the ACCI programme. This module has no supplementary exam.

Advanced Scientific Communication
AGRI820 P2   (18L-50T-0P-0S-92H-0R-0F-0G-0A-13W-16C)
Aim: To provide postgraduate students with the knowledge, understanding and skills they need for their research thesis, writing and publishing journal articles, and important forms of professional communication in management positions.
Content: Requirements for a research thesis; characteristic, functional features of the science journal research paper for both reader and writer; introduction to the publishing process; initial postgraduate.
Assessment: Continuous: Thesis outline (5%); initial literature review (35%); real/simulated journal article (35%); planning and sketches for poster (15%); basic types of business communication (10%).
DP Requirement: Not applicable.
To be offered only in the ACCI programme. This module has no supplementary exam.

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Agricultural Management
Offered in the School of Agricultural, Earth and Environmental Sciences

Current Issues in Agricultural Management
AMAN300 P2   (0L-26T-12P-20S-72H-0R-0F-10G-20A-13W-16C)
Prerequisite Requirement: 32C of AGEC or FINA at Level 2.
Corequisites: AGEC370
Aim: To identify contemporary issues facing agricultural managers in South Africa and globally, so that candidates can integrate and apply the knowledge derived during the degree to recommend how agricultural managers can respond to these issues in order to promote the long-term sustainability of farm businesses.
Content: Specific contemporary issues are expected to change from year to year based on new research into, and the focus of new knowledge about, issues facing agricultural managers in rapidly changing farm input and output markets in South Africa and globally. Candidates will identify relevant contemporary issues based on self-study and discussions with staff that have a background in lecturing modules, and in supervising research, related to agricultural management.
Assessment: Two case studies (20% and 30%) and two essays (50%). The two essays will be externally examined.
DP Requirement: Not applicable.
This module has no supplementary exam. Only for final-year students registered for the BAgricMgmt degree.

Agricultural Management Project and Seminar
AMAN790 PY   (0L-20T-0P-20S-280H-0R-0F-0G-0A-26W-32C)
Prerequisite Requirement: Admission to BAgricMgmtHons
Corequisite: AGEC740 and 750.

Aim: To equip candidates with the ability to: (a) critically review literature, write scientific papers, and formally present and defend their work; and (b) integrate theory and techniques covered in earlier modules to solve agricultural management problems.

Content: This module integrates topics covered in earlier modules. For the project, candidates must identify a relevant agricultural management research problem, develop theoretical models to test research hypotheses, collect and analyse data related to that problem, interpret results, recommend how to solve the problem, and prepare a comprehensive research report.

Assessment: Presentation of 1 seminar paper (33%) and a research project report (67%).

DP Requirement: Not applicable.

This module has no supplementary exam. Only for students majoring in BAgricMgmtHons (Production Stream) or (Commerce Stream).

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Agrometeorology

Offered in the School of Agricultural, Earth and Environmental Sciences

Agrometeorology & Environmental Biophysics
AMET210 P1   (36L-5T-40P-0S-50H-24R-0F-0G-5A-13W-16C)

Prerequisite Requirement: 32C at Level 1.

Aim: Provision of concepts and applications in applied environmental, agricultural and ecophysiological sciences.

Content: The atmosphere. Greenhouse effect. Climate change. Earth's radiation and energy balance. Remote sensing. Role of water in the environment. Glasshouse climate. Windbreaks. Energy and water exchange processes above canopies. Animal climate. Meteorology: rain processes. Weather systems.

Practicals: Temperature measurement; reflectivity, radiation profiles in crops; humidity; rainfall and evaporation; leaf resistance and water potential. Project.

Assessment: Tests 20%, Practicals 20%, Project 10%, 3h exam 50%.

DP Requirement: 80% attendance at lectures and practicals.

Environmental Instruments: Life/Earth Sciences
AMET211 P2   (20L-0T-39P-0S-0H-17R-0F-0G-4A-13W-8C)

Prerequisite Requirement: 32C at Level 1.

Aim: To provide students taking agriculture and environmental science options with the skills to set up an automatic weather station.

Content: Datalogging measurement and control techniques using an automatic weather station (AWS) and other sensors for measurement and control purposes. Internet techniques, information retrieval and storage and data display.

Practicals: Identifying, checking electronic components. Use of an AWS.

Assessment: Test (10%), practicals (23%); 3 h practical exam (67%).

DP Requirement: 80% attendance at all academic contact activities; 40% class mark. Students may not obtain credit for both AMET212 and AMET211.

Environmental Instruments: Life/Earth Sciences
AMET212 P2   (23L-0T-115P-0S-0H-17R-0F-0G-5A-13W-16C)

Prerequisite Requirement: 64C at Level 1.

Aim: To provide students taking agriculture and environmental science options with the skills to set up an automatic weather station.

Content: Datalogging measurement and control techniques using an automatic weather station (AWS) and other sensors for measurement and control purposes. Internet techniques, information retrieval and storage and data display.

Practicals: Identifying, checking electronic components. Use of an AWS. Grass reference estimation; fire index; wind chill and chilling index estimation. Internet techniques, information retrieval and storage and data display.
Assessment: Test (5%), 13 practicals (12 %), project (50%); 3 h practical exam (33%).
DP Requirement: 80% attendance at all academic contact activities, 100% at practicals; 45% subminimum on the project.
Students may not obtain credit for both AMET212 and AMET211.

Agric/Environment Instrumentation Research
AMET800 PY   (0L-0T-520P-0S-440H-0R-0F-0G-0A-26W-96C)
Aim: To allow distance students to undertake a research project at their place of employment.
Content: Research on a topic agreed upon by the supervisor, the student and the employer(s).
Practicals: These form the basis of the research project.
Assessment: 1 project report (100%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam.

Evaporation Estimation
AMET860 PY   (20L-5T-18P-0S-27H-7R-0F-0G-3A-26W-8C)
Aim: To provide students with the theory necessary to understand the principles of evaporation estimation and techniques for turbulence measurement.
Content: Water and energy in the environment; radiation and energy transfer; lysimetry; atmometers. Sap flow theory and measurement; Bowen ratio, eddy covariance, surface renewal. Penman-Monteith equation and use; infra-red thermometry; energy balance closure; Monin-Obukhov similarity theory; scintillometry.
Practicals: Field use of equipment and sensors; advanced data analysis using a spreadsheet including VBA.
Assessment: 1 h test (33%); 2 h exam (67%).
DP Requirement: 80% attendance at lectures and practicals.
Year-long module.

Automatic Weather Station Technologies 1
AMET861 PY   (20L-5T-18P-0S-27H-7R-0F-0G-3A-26W-8C)
Aim: To provide theory and skills to set up an automatic weather station and the checking and use of collected data. Included here is the checking of the electronic components and an understanding of the sensors used.
Content: Datalogging measurement and control technologies, including datalogging programming. Theory of sensors used. Procedures for the checking and use of automatic weather station (AWS) data. Data processing and presentation. Theory and use of the AWS sensors and their use for measurement and control. Data telecommunication techniques.
Internet techniques, information retrieval and storage, scientific graphics display.
Practicals: Field use of equipment. Advanced data analysis using a spreadsheet.
Assessment: 1 h test (33%); 2 h exam (67%).
DP Requirement: 80% attendance at lectures and practicals.
Year-long Module.

Digital Data Treatment & Representation
AMET862 PY   (20L-5T-18P-0S-27H-7R-0F-0G-3A-26W-8C)
Aim: To provide students with the skills necessary to process and exchange, present, store, retrieve, display and publish data and information.
Content: Data presentation and information. Data exchange. Internet techniques. Data retrieval and information storage. Desk-top publishing. Display of scientific graphics. Speed reading and report writing.
Practicals: Assignments based on generated and other data sets.
Assessment: 1 h test (33%); 2 h exam (67%).
DP Requirement: 80% attendance at lectures and practicals.
Year-long Module.

AWS Measurement & Control Technologies

AMET863 PY   (20L-5T-18P-0S-27H-7R-0F-0G-3A-26W-8C)

Aim: To provide students with the theory necessary to understand the use of automatic weather station sensors for the measurement and control of various microclimates.

Content: Theory and use of automatic weather station (AWS) sensors and their use for measurement and control, for example, of frost protection, reference evaporation, glasshouse microclimate.

Practicals: Field use of equipment.

Assessment: 1 h test (33%); 2 h exam (67%).

DP Requirement: 80% attendance at lectures, 100% at practicals.

Year-long Module.

AWS Measurement & Control Technologies

AMET864 PY   (20L-5T-18P-0S-27H-7R-0F-0G-3A-26W-8C)

Aim: To provide students with the theory necessary to understand the following AWS systems and measurement systems.

Content: Theory and use of the following systems and sensors: automatic weather station (AWS) sensors and their use for measurement and control, for example, of disease forecasting, fire-danger warning; leaf wetness measurements, radio telemeters, infrared thermometry, AWS sensors, time-domain reflectometry.

Practicals: Field use of equipment and sensors.

Assessment: 1 h test (33%); 2 h exam (67%).

DP Requirement: 80% attendance at lectures and practicals.

Year-long Module.

Heat Pulse Measurement in Plants & Soils

AMET865 PY   (20L-5T-18P-0S-27H-7R-0F-0G-3A-26W-8C)

Aim: To provide students with the theory necessary to understand the following heat pulse technologies for use in soils and plants.

Content: Heat pulse technologies for the measurement of sap flow in trees and other non-woody stems and the measurement of the thermal properties of porous materials.

Practicals: Field use of equipment and sensors.

Assessment: 1 h test (33%); 2 h exam (67%).

DP Requirement: 80% attendance at lectures and practicals.

Year-long Module.

Modelling Exchanges in the SPAC System 1

AMET866 PY   (20L-5T-18P-0S-27H-7R-0F-0G-3A-26W-8C)

Aim: To provide students with the theory necessary to understand the principles of modelling energy and water flow in the SPAC.

Content: Principles of modelling: CERES and SWB models; modelling using finite differences; application of models; specialized data techniques for model evaluation.

Practicals: Field use of equipment and sensors.

Assessment: 1 h test (33%); 2 h exam (67%).

DP Requirement: 80% attendance at lectures and practicals.

Year-long Module.

Environmental Temperature & Radiation

AMET867 PY   (20L-5T-18P-0S-27H-7R-0F-0G-3A-26W-8C)

Aim: To provide students with the theory necessary to understand the principles of temperature measurement and calibration of radiation instrumentation.

Content: Principles of temperature measurement using resistance thermometers, thermocouples and thermistors. Soil temperature and soil heat flux measurement. Net radiation and canopy interception measurement. Calibration of radiation instrumentation. Applications.
Practicals: Field use of equipment and sensors.
Assessment: 1 h test (33%); 2 h exam (67%).
DP Requirement: 80% attendance at lectures and practicals.
Year-long Module.

Evaporation Estimation
AMET870 PC   (23L-6T-21P-0S-88H-17R-0F-0G-5A-13W-16C)
Prerequisite Modules: AMET210, 212.
Aim: To provide students with the theory necessary to understand the principles of evaporation estimation and techniques for turbulence measurement.
Content: Water and energy in the environment; radiation and energy transfer; lysimetry; atmometers. Sap flow theory and measurement; Bowen ratio, eddy covariance, surface renewal. Penman-Monteith equation and use; infra-red thermometry; energy balance closure; Monin- Obukhov similarity theory; scintillometry.
Practicals: Field use of equipment and sensors; advanced data analysis using a spreadsheet including VBA.
Assessment: Practicals (8%), project (9%), two tests (16%), 3 h exam (67%).
DP Requirement: 80% attendance at lectures and practicals.

Automatic Weather Station Technologies 1
AMET871 PC   (23L-6T-21P-0S-88H-17R-0F-0G-5A-13W-16C)
Prerequisite Modules: AMET210, 212.
Aim: Aim: To provide theory and skills to set up an automatic weather station and the checking and use of collected data. Included here is the checking of the electronic components and an understanding of the sensors used.
Content: Data processing and presentation. Theory and use of the AWS sensors and their use for measurement and control. Data telecommunication techniques. Internet techniques, information retrieval and storage, scientific graphics display.
Practicals: Field use of equipment and sensors; advanced data analysis using a spreadsheet including VBA.
Assessment: Practicals (8%), project (9%), two tests (16%), 3 h exam (67%).
DP Requirement: DP Requirement: 80% attendance at lectures and practicals.
Offered in either Semester 1 or Semester 2.

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Animal Science

Offered in the School of Agricultural, Earth and Environmental Sciences

Pig & Poultry Production
ANSI201 P2   (38L-0T-39P-0S-38.5H-40R-0F-0G-4.5A-13W-16C)
Prerequisite Modules: BIOL101.
Aim: To enable students to solve problems encountered in pig and poultry production.
Content: Applied anatomy and physiology of male and female fowl. Environmental control of ovulation in hens. Management of pullet, broiler, broiler breeder and pig production systems. Economic factors influencing management decisions in broiler, egg and pork production. Pig and poultry welfare.
Practicals: Anatomy of pigs and poultry, incubation.
Assessment: Essays (12.5%), development of spreadsheet models (12.5%), oral & written presentations (7.5%), practical reports (7.5%), participation in debate on animal welfare issues (5%), formal tests (5%); 3 h exam (50%).
DP Requirement: Not applicable

Small Ruminant Production

ANSI207 P1 (38L-15T-24P-0S-35H-38R-0F-0G-10A-13W-16C)

Prerequisite Modules: BIOL101.

Aim: To enable students to learn how to manage and solve problems in sheep and goat production.

Content: Economic factors influencing management decisions in small ruminants. Functions, breeds, production systems, feeding behaviour, mating systems, reproductive management, genetic improvement, challenges, health and welfare of small ruminants.

Practicals: Sheep shearing and wool classing courses.

Assessment: Assignments, practical reports and tests (50%), 3 h exam (50%).

DP Requirement: Not applicable

Beef and Dairy Production

ANSI209 P2 (38L-15T-24P-0S-38H-40R-0F-0G-5A-0W-16C)

Prerequisite Modules: BIOL101.

Aim: To enable students to solve problems encountered in beef and dairy production.

Content: Breeds and breeding, production systems, feeding management, reproductive management, genetic improvement, health management, welfare, production challenges.

Practicals: Problem solving exercises, visit to farms, cattle judging course.

Assessment: Written assignments (15%), oral & written presentations (10%), practical reports (5%), formal tests (20%), 3 h exam (50%).

DP Requirement: Not applicable

Introduction to Monogastric Nutrition

ANSI311 P2 (38L-9T-30P-0S-39H-39R-0F-0G-5A-13W-16C)

Prerequisite Modules: BIOC201.

Aim: To provide the foundation principles for feeding monogastric animals.

Content: Interaction animal-feed-environment, digestive physiology and anatomy, control of feed intake, nutrient requirements, feeding systems, raw materials (composition, anti-nutritional factors, deficiencies and toxicities) quality control and feed formulation in monogastric animals.

Practicals: Modelling nutrient requirements, digestive physiology, raw material evaluation, chemical composition and analysis, energy and protein systems, feed formulation.

Assessment: Assignments and practical reports (25%), research project (5%), formal tests (20%); 3 h exam (50%).

DP Requirement: Not applicable

Subminimum requirement: 40% for Exam

Introduction to Ruminant Nutrition

ANSI312 P1 (38L-0T-39P-38.5S-40H-0R-0F-0G-4.5A-13W-16C)

Prerequisite Modules: BIOL101, 102.

Aim: To introduce ruminant digestive physiology and nutrition.

Content: Digestion (anatomy and physiology). Microbes, microbial niches, interdependence & interaction; rumen metabolism of carbohydrate, fats/lipids & proteins; factors affecting growth of microbes; synthetic activities of microbes; digestion of microbial matter; digestion products & their quality; feed additives that modify digestion; methods of measuring digestion and passage; factors affecting digestibility; partitions of food energy in relation to usefulness to drive metabolic processes (metabolisable energy and effective energy systems) and factors affecting metabolisable energy value and their efficiency; metabolisable protein; metabolisable energy systems. Feeds (grains; roughages, tubers), problem in minerals and vitamins nutrition.

Assessment: Essays (10%), reports on feed evaluation (10%); impromptu test (5%), formal test (25%); 3 h exam (50%).

DP Requirement: Not applicable

Animal Growth & Meat Quality

ANSI333 P1   (38L-0T-39P-0S-47H-32R-0F-0G-4A-13W-16C)

Aim: Students should analyse the relationships between body size and composition over time as a means of predicting the consequences of internal and external stimuli on growth and development of domestic and non-domestic animals.

Content: Basic growth terminology, analysis of growth curves, scaling and allometry, growth modelling, manipulation of growth, physiology of muscles, conversion of muscle to meat and meat quality.

Practicals: Allometric measurements and analyses. Animal growth experiments, including allometric measurements and analyses.

Assessment: Practical reports (20%), essay (10%), formal tests (20%); 3 h exam (50%).

DP Requirement: Not applicable

Subminimum requirement: Students are required to achieve an exam mark of at least 40% in order to pass the module.

Animal Health

ANSI352 P1   (38L-10T-35P-0S-54H-18R-0F-0G-5A-13W-16C)

Prerequisite Modules: BIOL101.

Aim: To enable students to understand the complexities of maintaining animal health and welfare and its effects on constraining potential. Also to maintain health and welfare in an economically and commercially sustainable manner.

Content: Disease causation and identification. Immunology & vaccination. Hygiene, medical prophylaxis and treatment. Epidemiology. Public health and zoonoses. Animal disease legislation, disease control strategies and programmes.

Practicals: Biological sampling & preparation for submission to diagnostic laboratory, post-mortem examination, basic prophylaxis for disease farm species, visit to diagnostic laboratories.

Assessment: Written assignments (10%), oral & written presentations (15%), prac. reports (10%), tests (15%); 3 h exam (50%).

DP Requirement: Not applicable

Applied Reproductive Physiology

ANSI370 P2   (38L-0T-39P-0S-54.5H-24R-0F-0G-4.5A-13W-16C)

Aim: Students will learn to integrate animal physiology and endocrinology with nutritional, behavioural, health and environmental factors by implementing strategies for improving reproductive efficiency.

Content: Reproductive cycles. Control of ovulation. Follicular development. Sexual behaviour. Oestrus detection. Superovulation. Artificial insemination. Seasonal breeding. Improving and evaluating reproductive efficiency. Reproduction technology and bioethics.

Practicals: AI course and dissections.

Assessment: Essays (10%), oral presentations (15%), formal tests (20%), project (5%); 3 h exam (50%).

DP Requirement: Not applicable

Companion Animal Nutrition

ANSI703 P2   (38L-0T-39P-0S-39H-39R-0F-0G-5A-13W-16C)

Aim: To familiarise students with the pet food industry and to integrate nutritional principles with the peculiarities of various companion animal requirements.

Content: Unique nutrient requirements and feeding management of cats, dogs and horses. Feeding for activity, reproduction, health and longevity. Preparation of food and its effect on nutrient quality. Regulation, marketing and labelling of pet food. Dynamics of the pet food industry in South Africa.

Practicals: Determine nutrient requirements of pets. Marketing and labelling of pet food. Trips to feed companies.

Assessment: Problem-solving based tests (10%), essays (5%), practicals (25%), oral & written presentations (10%); 3 h exam (50%).

DP Requirement: Not applicable

Subminimum requirement: Students are required to achieve an exam mark of at least 40% in order to pass the module.

Advanced Monogastric Nutrition
ANSI711 P1   (38L-9T-30P-0S-39H-39R-0F-0G-5A-13W-16C)
Prerequisite Modules: ANSl311.
Aim: Students should integrate their nutritional and production knowledge to enable them to formulate feeds for different production systems and to solve more advanced nutritional problems using simulation models.
Content: Determination and estimation of nutrient requirements through experimental nutrition, data analysis and interpretation, advanced feed formulation for pigs and poultry systems. Raw material matrix, use of enzymes in monogastric feed. Economic evaluation of feed. Current legislation on raw materials and medication used in monogastric feed. Optimisation.
Practicals: Computer based calculations for nutrient requirements, feed composition and formulation, raw material evaluation, nutritional problem solving.
Assessment: Assignments and practical reports (25%), oral presentations/research project (5%), formal tests (20%); 3 h exam (50%).
DP Requirement: Not applicable
Subminimum requirement: Students are required to achieve an exam mark of at least 40% in order to pass the module.

Rumen Metabolism and Feed Formulation
ANSI712 P2   (20L-10T-39P-0S-54H-22R-0F-10G-5A-13W-16C)
Prerequisite Modules: BIOC201, ANSI312.
Aim: To increase students' skills in determining requirements, feed formulation and in metabolism of carbohydrate and protein in ruminants.
Content: Metabolism of carbohydrates and protein in the rumen; Concept of effective fibre; protection and supplementation with protein; ruminal microbial protein synthesis; stoichiometry of hexose utilization; requirement for maintenance, growth or fattening, and lactation. Ration formulation.
Practicals: Computer based calculations of requirements and diet formulation.
Assessment: Two class tests, one practical write-up, group seminar presentation (50%); 3 h exam (50%).
DP Requirement: Not applicable

Animal Science Research Project & Seminars.
ANSI792 PY   (12L-10T-206P-4S-248H-0R-0F-0G-0A-26W-48C)
Aim: The focus is on integrated assessment of the exit-level outcomes specified for the programme in Animal and Poultry Science. It involves information and data management, analysis and communication, self-evaluating reflection and personal organization.
Content: Review paper writing. Literature search, Presentation skills. Topical discussions with industry members. Formulating and presenting a research project proposal. Conducting an experiment, analysing results, and presenting the project as a scientific paper. 5 weeks of work experience.
Assessment: Spreadsheets and hardcopy of trial/llab notes (10%), Literature review (Oral (10%); written submission (35%)) scientific paper (oral (10%): written submission (35%))
DP Requirement: Not applicable.
Subminimum Requirement: Students must complete 5 weeks of work experience in an Animal Science related field; assessed by submission of a portfolio of evidence judged by a panel comprising Animal Science academic staff.
Year-long Module. This module has no supplementary exam.

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Applied Chemistry

Offered in the School of Chemistry and Physics

Environmental Chemistry
APCH211 W2   (27L-9T-36P-0S-66H-17R-0F-0G-5A-13W-16C)
Prerequisite Modules: CHEM110, CHEM120.

Aim: To introduce a wide range of science students to the principles of environmental chemistry.
Content: Chemical pollution: acid rain, photochemical smog, global warming, and ozone depletion. Water purification, recycling and waste management. The toxicity of heavy metals and organic compounds.
Practicals: A combination of laboratory work, assignments and workshops.
Assessment: Tests (8%), practicals (25%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
Only for students in the Applied Chemistry programme. Entrance into the Applied Chemistry Programme is limited and will be based on merit.

Chemistry & Industry
APCH221 W1   (27L-9T-36P-0S-67H-17R-0F-0G-4A-13W-16C)
Prerequisite Modules: CHEM110, CHEM120.
Aim: To highlight how chemistry can be applied to create a successful industrial venture.
Content: Insights into the South African and global chemical industry, highlighting the chemistry, the manufacturing processes, the costs and profits and the environmental consequences. A holistic view will be taken where one or two processes will be covered in detail outlining the cradle-to-grave approach necessary in today's economic and social climate.
Practicals: A combination of laboratory work, assignments and workshops.
Assessment: Tests (8%), practicals (25%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
Only for students in the Applied Chemistry programme. Entrance into the Applied Chemistry Programme is limited and will be based on merit.

Chemical Analysis
APCH231 W2   (27L-9T-36P-0S-67H-17R-0F-0G-4A-13W-16C)
Prerequisite Modules: CHEM110, CHEM120 and (MATH130, 150 or 195).
Aim: To show the role and importance of analytical chemistry in industry and society and to provide basic theory and practical skills in "wet analytical" techniques.
Content: Analytical methodology, titrimetric and gravimetric methods of analysis, errors and uncertainties in measurements, principles of calibration, industrial applications.
Practicals: Volumetric and gravimetric analysis. Treatment of experimental results. Generation of calibration curves.
Assessment: Tests (10%), practicals & assignments (30%); 3 h exam (60%).
DP Requirement: Practical mark 50%, 80% attendance at practicals, 100% attendance at tests.
Only for students majoring in Chemistry and/or Applied Chemistry. Entrance into the Applied Chemistry Programme is limited and will be based on merit.

Materials
APCH312 W1   (27L-9T-36P-0S-67H-17R-0F-0G-4A-13W-16C)
Prerequisite Modules: CHEM210, 230.
Aim: To show the relationship between the microstructure and macroscopic properties of materials.
Content: Introduction to the atomic structures of crystalline materials, glasses and polymers. The relationship between structure, microstructure and useful macroscopic properties.
Practicals: Preparation and characterisation of various materials.
Assessment: Tests (10%), practicals (15%), assignment (5%); 3 h exam (70%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
Only for students in the Applied Chemistry programme. Entrance into the Applied Chemistry Programme is limited and will be based on merit.

Industrial Chemistry
APCH322 W1   (27L-6T-36P-0S-68H-18R-0F-0G-5A-13W-16C)
Prerequisite Modules: CHEM230.

Corequisite: CHEM330.
Aim: To make students aware of the link between the traditional subjects of chemistry and chemical engineering.
Content: The industrial manufacturing process, qualitative and quantitative process flow diagrams, unit operations and unit processes, mass and energy balances on steady state systems – recycle, bypass and purge, heat exchangers and steam tables, industrial separations and applications of phase chemistry.
Practicals: Phase chemistry; problem-solving workshops; flow sheet simulation using computer software; industrial project. The course includes field trips.
Assessment: Tests (5%), practicals (14%), assignments (14%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
Students may be required to contribute to the cost of field trips. Only for students in the Applied Chemistry programme. Entrance into the Applied Chemistry Programme is limited and will be based on merit.

Environmental Analysis
APCH332 W2   (27L-9T-36P-0S-67H-17R-0F-0G-4A-13W-16C)
Prerequisite Modules: CHEM230; APCH231 or CTEC233.
Aim: To show the role and importance of analytical chemistry in studying the environment.
Content: Speciation, partition and transport, solubility, advanced analytical techniques, sampling: strategy, techniques and preservation.
Practicals: Sampling and analysis of real systems, use of modern instrumental methods of analysis.
Assessment: Tests (10%), practicals (23%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals and workshops, 100% attendance at tests.
Only for students in the Applied Chemistry programme. Entrance into the Applied Chemistry Programme is limited and will be based on merit.

Integrated Project
APCH342 W2   (20L-0T-54P-0S-77H-0R-0F-0G-9A-13W-16C)
Prerequisite Modules: CHEM210, 220, 230, 340; APCH231 or CTEC233.
Aim: To develop an integrated approach to practical work.
Content: This module builds on elementary experimental techniques and focuses on experimental chemistry as a whole rather than as isolated segments of laboratory work. It is intended that students learn to carry out independent research/study. Sampling strategy, practical methodology, research techniques, record-keeping, writing laboratory reports, library practice and data sources, use of spreadsheets in chemistry.
Practicals: Mini-projects.
Assessment: Continuous assessment of laboratory work, written project reports and seminar (80%), tests and assignments (20%).
DP Requirement: Not applicable.
Only for students in the Applied Chemistry programme. Entrance into the Applied Chemistry Programme is limited and will be based on merit. This module has no supplementary exam.

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Astronomy

Offered in the School of Mathematics, Statistics and Computer Science

Stars and Planets
ASTR203 W1   (29L-20T-20P-0S-51H-20R-0F-0G-20A-13W-16C)
Prerequisite Modules: MATH130 or 195; MATH140 or 196; PHYS110/113, 120/114.
Aim: To provide students with an introduction to astronomy.
Content: History of astronomy, astronomical concepts (such as the magnitude scale and coordinate systems), the solar system, properties of stars and stellar evolution.
Assessment: Assignments (30%), class test (10%); 3 h exam (60%).

DP Requirement: 35% Class mark, 80% attendance at tutorials.

Galaxies and Cosmology
ASTR204 W2   (29L-20T-20P-0S-51H-20R-0F-0G-20A-13W-16C)
Prerequisite Modules: ASTR201 or 203
Aim: To provide students with an introduction to extragalactic astronomy and cosmology.
Content: Structure of the Milky Way, the cosmic distance ladder, classification of galaxies, stellar populations of galaxies, surface photometry and scaling relations of galaxies, luminosity functions, galaxy environments, galaxy evolution, properties of active galactic nuclei, large scale structure and the evolution of the Universe.
Assessment: Assignments (30%), class test (10%); 3 h exam (60%)
DP Requirement: 35% class mark, 80% attendance at tutorials.

Astronomy Beyond the Visible
ASTR301 W1   (29L-20T-20P-0S-51H-20R-0F-0G-20A-13W-16C)
Prerequisite Modules: ASTR201 or 203, 202 or 204
Aim: To provide students with an introduction to high energy astrophysics and non-thermal processes in the Universe, and the instruments to detect radiation from such sources across a wide range in wavelength.
Content: Radiative transfer, ionisation losses and bremsstrahlung radiation, synchrotron radiation, high energy photon interactions, accretion in astrophysics, telescopes and detectors at gamma-ray, X-ray, UV, IR, sub-mm and radio wavelengths, radio interferometry.
Assessment: Assignments (30%), class test (10%); 3 h exam (60%).
DP Requirement: 35% class mark, 80% attendance at tutorials.

Observational Project
ASTR304 W1   (4L-10T-40P-0S-13H-0R-0F-3G-90A-13W-16C)
Prerequisite Modules: ASTR201 or 203, 202 or 204
Aim: To provide a practical introduction to observational techniques used in astronomical research, with students designing and executing a small research project using a small telescope.
Content: Signal-to-noise calculations for astronomical detectors, observing proposals and the peer review process, observing with a small telescope, astronomical data reduction and analysis.
Practicals: May involve a field trip to the South African Astronomical Observatory in Sutherland. Otherwise, projects will be executed using a small telescope on campus.
Assessment: Observing proposal (40%); participation in peer review exercise (10%); project report (50%).
DP Requirement: Not applicable.

Fluids in Astrophysics
ASTR303 W2   (29L-17T-0P-0S-60H-24R-0F-0G-30A-13W-16C)
Prerequisite Modules: ASTR201 or 203, 202 or 204, MATH251.
Aim: To introduce students to mathematical and numerical methods used in modelling astrophysical systems.
Content: Applications of vector calculus, ordinary and partial differential equations, and numerical methods to astrophysical fluid dynamics.
Assessment: Assignments (30%), class test (10%); 3 h exam (60%).
DP Requirement: 35% class mark, 80% attendance at tutorials.

Biochemistry

Offered in the School of Life Sciences

Biochemistry and Microbiology for Optometry
BIMI200 W1   (30L-9T-36P-0S-46H-24R-0F-0G-15A-13W-16C)
Prerequisite Modules: (BIOL101 or 103), CHEM110.
Aim: To provide an overview of Biochemistry & Microbiology for Optometry students.
Content: Carbohydrates, lipids, amino acids & proteins. Vitamins, cofactors, enzymes & nucleic acids. Selected clinical correlations. Bacterial cell structure & function. Physical and chemical control of bacterial growth. Infection, epidemiology and prevention of infection. Microbial infections of the eye. Immunology and immunological disorders of the eye.
Practicals: Carbohydrates, proteins and lipids. Aseptic technique, ubiquity of microbes, equipment contamination, microscopic observation of microorganisms, microbial control: antibiotic sensitivity, sterilization and disinfection.
Assessment: Practical reports (5%), theory tests (35%), 2 theory of practical tests (10%), 3 h exam (50%).
DP Requirement: Class mark of 40%. Attendance at 80% of tutorials and 100% of tests. **For students in the College of Health Sciences only.**

Introduction to Biomolecules
BIOC201 P1 W1   (39L-10T-39P-0S-48H-18R-0F-0G-6A-13W-16C)
Prerequisite Modules: (BIMI120 or BIOL101). CHEM110, CHEM120.
Aim: To provide an insight into the molecular diversity in living systems.
Content: Hierarchy of chemical structures in prokaryotic and eukaryotic cells. Chemistry of carbohydrates, amino acids, peptides and proteins. Introductory enzymology and kinetics. Structure and function of vitamins and cofactors. Nucleic acid biochemistry and protein synthesis.
Practicals: Analyses of carbohydrates, amino acids, proteins and vitamins.
Assessment: Theory tests (25%), practical test and reports (25%); 3 h exam (50%).
DP Requirement: Class mark of 40%. Attendance at 80% of tutorials and practicals.
Credit may not be obtained for both of BIOC201 and BIOC203.
Entry to this module may be restricted to students that are registered for a major or programme in which this module is specifically listed as core or as a core elective.

Bioenergetics and Integrated Metabolism
BIOC202 W2   (39L-10T-39P-0S-48H-18R-0F-0G-6A-13W-16C)
Prerequisite Modules: (BIOL101 or BIMI120), CHEM110, CHEM120.
Aim: To introduce students to integrated biochemical pathways.
Content: The biosynthesis and oxidation of simple and complex lipids, lipid storage disorders. The metabolism of carbohydrates, amino acids, nucleotides and one-carbon fragments. Clinical correlations resulting from aberrations in individual metabolic pathways. Bioenergetics, regulation and control of metabolic pathways.
Practicals: Spetrophotometric techniques, electrophoresis and chromatography of serum and other metabolites.
Assessment: Class Tests (25%), practical test and reports (20%); Tutorials and/or assignments (5%), 3 h exam (50%).
DP Requirement: Class mark of 40%. Attendance at 80% of practicals and tutorials and 100% of tests. **Credit may not be obtained for both of BIOC202 and BIOC203.**
Entry to this module may be restricted to students that are registered for a major or programme in which this module is specifically listed as core or as a core elective.

Biochemistry for Biologists
BIOC203 W1   (39L-0T-39P-0S-65H-11R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 64C at Level 1 including CHEM110, BIOL101, BIOL102.

Aim: To provide an overview of Biochemistry for Biologists in order to understand the processes involved in cellular metabolism, and the experimental techniques used to facilitate understanding in this field.

Content: Chemistry and metabolism of carbohydrates, lipids, amino acids and proteins. Introduction to enzymology and kinetics. Clinical correlations resulting from aberrations in individual metabolic pathways. Bioenergetics, regulation and control of metabolic pathways.

Practicals: Experimental techniques in biochemistry.

Assessment: Class Tests (25%), practical test and reports (20%); Tutorials/Assignments (5%), 3 h exam (50%).

DP Requirement: Class mark of 40%. Attendance at 100% of tests, and 80% of practicals and tutorials.

Credit may not be obtained for both BIOC203 and either of BIOC201 or BIOC202.

Signal Transduction and Metabolism

BIOC212 P2   (39L-10T-30P-0S-52H-22R-0F-0G-7A-13W-16C)

Prerequisite Requirement: 40% in BIMI120 or BIOL101.

Prerequisite Modules: CHEM110, 120.

Aim: To introduce the fundamentals of cell biology.

Content: Properties and function of biological membranes and subcellular organelles. Bioenergetics of metabolism. Carbohydrate, lipid and amino acid metabolism. Integration and regulation of metabolic pathways in animals, humans, plants, and microbes. Control of cell behaviour.

Practicals: Metabolic pathways and cellular respiration including glycolysis, the citric acid cycle and the electron transport chain.

Assessment: Theory tests (25%), practical test and reports (25%); 3 h exam (50%).

DP Requirement: Class mark of 40%. Attendance at 80% of tutorials and practicals.

Cellular Regulation and Signalling

BIOC300 P2   (30L-9T-36P-0S-55H-25R-0F-0G-5A-13W-16C)

Prerequisite Modules: BIOC201, 212.

Aim: To provide insight into cellular processes and the role of signal transduction pathways in their regulation in cells and the whole organism.

Content: The integration and regulation of cellular processes under normal, stressful- (e.g. diabetes), diseased (e.g. cancer) and toxic conditions (e.g. microbial toxins, drugs), and associated signalling pathways.

Practicals: Imaging, computer and laboratory-based practicals in metabolism and cell biology.

Assessment: 2 h tests (30%), practical reports and assignments (20%); 3 h exam (50%).

DP Requirement: Class mark of 40%. Attendance at 80% of tutorials and practicals.

RNA Chemistry and Gene Expression

BIOC307 W1   (30L-7T-36P-0S-57H-25R-0F-0G-5A-13W-16C)

Prerequisite Requirement: 40% in CHEM220.

Prerequisite Modules: BIOC201, 202, RDNA202.

Aim: To introduce students to more advanced aspects of gene expression in prokaryotes and eukaryotes.

Content: Structure and chemistry of RNA. RNA-modifying enzymes. Transcription in prokaryotes and eukaryotes. Control of transcription. Inhibitors, enhancers, promoters and transcription factors. Post-transcriptional modifications of RNA. Aminoacyl tRNA synthetases, codon-anticodon interactions, ribosome structure/morphology. Polypeptide synthesis, translational accuracy, inhibitors and control of translation. Post-translational modifications and protein degradation.

Practicals: Methods of RNA isolation, characterization and quantification.

Assessment: 2 h class tests (25%), practical reports and assignments (25%); 3 h exam (50%).

DP Requirement: Class mark of 40%. Attendance at 80% of practicals and 100% of tests.

Physiological Biochemistry

BIOC308 W2   (30L-7T-36P-0S-57H-25R-0F-0G-5A-13W-16C)

Prerequisite Modules: BIOC201, 202, CHEM220, RDNA202.

Aim: To introduce students to the physiological relatedness of various biomolecules.
Content: Sterol and hormone biosynthesis and regulation, lipoprotein structure and metabolism, inborn errors and gene therapy, biomembranes structure and function and signal transduction. Viral and chemical carcinogenesis.
Practicals: Properties and analysis of ATP, genetic mutation, isoenzymes and polyacrylamide gel electrophoresis.
Assessment: 2 h class tests (25%), practical reports and assignments (25%); 3 h exam (50%).
DP Requirement: Class mark of 40%. Attendance at 80% of practicals and 100% of tests.

Biochemical Methods
BIOC311 P1   (30L-9T-36P-0S-55H-25R-0F-0G-5A-13W-16C)
Prerequisite Modules: BIOC201, 212, PHYS131.
Aim: To introduce techniques for protein, DNA, lipid and carbohydrate identification, isolation and analysis for biochemical, biological, medical, agricultural, and food sciences.
Content: Identification, extraction, separation and analysis of proteins, DNA, lipids and carbohydrates; centrifugation, precipitation, chromatography, electrophoresis, laboratory safety, cell culture, accessing the scientific literature.
Practicals: Techniques for protein, DNA, lipid and carbohydrate identification, isolation and analysis
Assessment: 2 h class tests and assignments (24%), practical reports (16%); 3 h exam (60%).
DP Requirement: Class mark of 40%. Attendance at 80% of tutorials and practicals.

DNA Chemistry
BIOC315 P1 W1   (30L-12T-25P-0S-63H-25R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 40% in CHEM220.
Prerequisite Modules: BIOC201, (BIOC202 or 212), RDNA202.
Aim: To provide a detailed account of the chemistry and biochemistry of DNA and aspects of its manipulation.
Content: Molecular structure, enzymology, synthesis and repair of nucleic acids; advanced recombinant nucleic acid methodology, sequencing and analysis.
Practicals: DNA isolation, characterisation and manipulation.
Assessment: 2 h class tests (30%), practical reports and assignments (20%); 3 h exam (50%).
DP Requirement: Class mark of 40%. Attendance at 80% of tutorials and practicals.

Immuno- and Protein Chemistry
BIOC316 P2 W2   (30L-12T-25P-0S-63H-25R-0F-0G-5A-13W-16C)
Prerequisite Modules: BIOC201, (BIOC202 or 212), CHEM220, RDNA202.
Aim: To introduce a biochemical view of immunology and advanced aspects of protein conformation as well as to develop skills in the concomitant laboratory techniques.
Content: Innate and acquired immunity, biochemistry of humoral and cell-mediated immune responses, antibodyantigen interactions, immune cell receptors, cytokines; protein conformation and folding; peptide synthesis.
Practicals: Physico-chemical analysis of proteins and immunochemical techniques.
Assessment: 2 h class tests (25%), practical reports and assignments (25%); 3 h exam (50%).
DP Requirement: Class mark of 40%. Attendance at 80% of tutorials and practicals.

Cell Biology & Methods in Cell Biology
BIOC701 P1   (24L-24T-66P-0S-29H-6R-0F-8G-3A-13W-16C)
Aim: To introduce the theoretical aspects of intracellular trafficking of biomolecules.
Content: Topological continuity between organelle lumens and extracellular space; glucoprotein synthesis and trafficking; composition and autoassembly of extracellular matrix; structure and function of cytoskeleton; reciprocity between intracellular and extracellular order; relevance to cellular diseases such as cancer; stem cell biology. Methods in subcellular fractionation, histochemistry, immunochemistry, various electron microscopy techniques, cell culture and lysosome-endosome trafficking.
Practicals: Cell culture and immunocytochemistry applications.
Assessment: Assignments (20%), practical reports (20%); 3 h exam (60%).
DP Requirement: Class mark of 40%, attendance at 80% of tutorials and practicals.

Research Project
BIOC702 PY WY   (0L-20T-320P-8S-109H-10R-0F-12G-1A-26W-48C)
Aim: To train students in research methodology through the vehicle of a research project in Pure and Applied Biochemistry.
Content: Students will prepare and deliver seminars in selected areas of Biochemistry including fields such as Malaria, Poultry Pathogens, Immunodiagnostics, Trypanosomiasis, Immunotechnology, Immunocytochemistry, Electron microscopy, Cancer, Mechanisms of metastasis, Stem cells, Biochemical Education, Enzyme analysis, Modelling and purification, Biotechnology and undertake a research project selected under the supervision of staff.
Assessment: Dissertation and oral presentation (100%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam.

Antigens and Vaccines
BIOC703 P1   (24L-24T-66P-0S-29H-6R-0F-8G-3A-13W-16C)
Aim: To introduce the student to antigen presentation and vaccine design.
Content: Vaccine development - the malaria and HIV models; immunological, parasitological, molecular and metabolic considerations for host and parasite. Preparation and evaluation of affinity purified antigens. In silico vaccine design. Molecular Modelling. Antigen processing and presentation.
Practicals: Epitope mapping, advanced immunochemical techniques.
Assessment: Assignments (20%), practical reports (20%); 3 h exam (60%).
DP Requirement: Class mark of 40%, attendance at 80% of tutorials and practicals.

Modelling, visualisation & information retrieval
BIOC705 P1   (24L-24T-66P-0S-29H-6R-0F-8G-3A-13W-16C)
Aim: To critically evaluate current Biochemistry literature. To give students insight into the use of models, modelling and animations as visualization tools for biochemistry education and research.
Content: Biochemistry journal article discussion and presentation. Meaning, type and examples of models. Use of models, modelling and animations as visualization tools in teaching and research. The cognitive process of visualizing and interpreting models. Research methods for identifying visualization difficulties. Improving visual literacy in biochemistry.
Assessment: Assignments (75%) and oral presentations (25%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Advanced Biochemistry Topics
BIOC707 PC   (0L-20T-57P-44S-35H-0R-0F-2G-2A-13W-16C)
Aim: To develop skills to access, collect and present scientific information on contemporary topics in Biochemistry.
Content: Written and oral presentations on selected topics. Data collection, recording and analysis on selected topics.
Assessment: Assignments (70%) and written test (30%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Advanced Biochemical Core Topics 3
BIOC708 W2   (24L-20T-0P-0S-93H-18R-0F-0G-5A-6W-16C)
Aim: To introduce students to selected advanced aspects of gene regulation and applications of gene products in biotechnology.
Content: Industrial, medical and pharmaceutical applications of gene products. Students will critically analyse recent peer-reviewed scientific publications.
Assessment: 2 h tests and assignments (25%); 3 h exam (75%).
DP Requirement: Attendance at 100% of tests and submission of all assignments.

Advanced Biochemical Core Topics 1

BIOC709 W1   (24L-20T-0P-0S-93H-18R-0F-0G-5A-6W-16C)

Aim: To instruct students in gene transfer and methodologies.
Content: Selected advanced topics from the areas of gene transfer protocols and reporter gene assay techniques. The module will help develop theoretical competence and capacity in these areas.
Assessment: 2 h class tests and assignments (25%); 3 h exam (75%).
DP Requirement: Attendance at 100% of tests and submission of all assignments.

Agric Biochemistry Research Skills

BIOC710 PC   (12L-20T-40P-44S-32H-0R-0F-0G-10G-2A-13W-16C)

Aim: To Introduce students to contemporary Biochemistry research skills.
Content: Qualitative and quantitative analysis, manipulation and interpretation of experimental and in silico data. Statistical analysis of Biochemical data. Financial research planning and management. Animal and human research ethics.
Assessment: Assignments (75%) and oral presentations (25%).
DP Requirement: Not applicable.
Offered in either Semester 1 or 2. This module has no supplementary exam.

Specialized Biochemical Techniques 1

BIOC711 W1   (10L-10T-90P-0S-39H-8R-0F-0G-3A-6W-16C)

Aim: To instruct students in the practical aspects of mammalian cell culture and the transfection of selected cell lines.
Content: The propagation and cryopreservation of mammalian cells including immortal lines. Selected cell based assays to be conducted.
Assessment: Practical report (50%); 3 h exam (50%).
DP Requirement: Attendance at 100% of tutorials and practicals.

Advanced Biochemical Core Topics 2

BIOC713 W1   (24L-20T-0P-0S-93H-18R-0F-0G-5A-6W-16C)

Aim: To instruct students in recombinant DNA technology.
Content: Selected topics in recombinant DNA technology.
Assessment: 2 h class tests and assignments (25%); 3 h exam (75%).
DP Requirement: Attendance at 100% of tests and submission of all assignments.

Specialized Techniques in Biochemistry

BIOC715 W1   (29L-20T-60P-0S-35H-10R-0F-0G-6A-6W-16C)

Aim: To familiarise students with selected advanced biochemical techniques and methodologies.
Content: Laboratory safety. Scientific writing, bioethics. Quantitative methodologies, biostatistics. Preparation of reagents and media, culture preservation. Nucleic acid isolation, agarose gel electrophoresis and gel documentation; protein isolation, SDS PAGE, Western blotting. Non-radioactive detection techniques. PCR, centrifugation, electron microscopy, HPLC, GC-MS. Introduction to bioinformatics.
Assessment: Practicals (30%), theory tests (40%), oral exam (30%).
DP Requirement: Attendance at 100% of tests and practicals.
Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined component. This module has no supplementary exam.

Biological Sciences

Offered in the School of Life Sciences

The Smaller Side of Life
BIOL101 P1 W1   (39L-10T-36P-0S-43H-24R-0F-0G-8A-13W-16C)
Aim: To introduce basic concepts of biology, such as biological molecules,   cellular structure and function and genetics.
Content: Living organisms, origin and diversity of life. Important biological molecules and metabolic processes. Cell theory, prokaryotic cells, and eukaryotic cells. Mitosis & meiosis. Introductory genetics. Basic concepts in Virology, Mycology, Bacteriology and Biochemical reactions.
Practicals: Selected from topics above.
Assessment: Tests/assignments (20%), practical reports (20%), 3 h practical test (10%); 3 h theory exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals.
Subminimum to pass: 40% in exam. Credit may not be obtained for both BIOL101 and BIOL195.

Life on Earth
BIOL102 P2 W2   (39L-10T-37P-0S-51H-15R-0F-0G-8A-13W-16C)
Aim: To develop basic knowledge and understanding of the diversity of organisms, their origin and their importance.
Content: Levels of biological complexity. Evolutionary innovations and radiation of organisms (bacteria, fungi, plants and animals). Principles of classification. Biodiversity and conservation.
Practicals: Selected from the topics above and/or field trips.
Assessment: Tests/assignments (30%), practical reports (20%); 3 h theory exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals.
Subminimum to pass: 40% in each exam. Credit may not be obtained for both BIOL102 and BIOL196.

Introductory Biology for Health Sciences
BIOL103 W1   (39L-10T-39P-0S-60H-5R-0F-0G-7A-13W-16C)
Aim: To introduce students to a range of biological topics pertinent to the health sciences.
Content: This module comprises three themes: history and diversity of life, basic toxicology, cellular biology, cytology and genetics. Where possible, students are shown how these topics apply to real-life situations.
Practicals: Viruses, Archaea, Bacteria, Eukaryotes, Protista, Fungi, Rhodae, Stromenopilae, spore-producing and seed-producing Plantae, biomolecules, mitosis and meiosis, membrane structure and function, structure of plant and animal cells, Hardy-Weinberg principle.
Assessment: Theory tests (20%), practical tests (15%); practical reports (15%); 3 h theory exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.
Service module for College of Health Sciences, not available in the College of Agriculture, Engineering and Science. Subminimum to pass: 40% in exam.

Smaller Side of Life (Augmented)
BIOL195 PY WY   (78L-20T-72P-0S-79H-60R-0F-0G-11A-26W-16FC-16DC)
Aim: To introduce structure, function and synthesis of biological molecules, structure and function of cells, introductory classical genetics.
Content: This module is available only to students registered for the BSc4 (Augmented stream). It covers the syllabus of BIOL101 but, in addition, includes a substantial amount of supplementary material and tuition designed for students who are under-prepared for university-level studies to a maximum of 160 additional hours.
Practicals: Experimental design, enzymes, biomolecules, DNA, observation, microscopy, mitosis/meiosis, genetics.
Assessment: Tests/assignments (30%), practical reports (20%), 3 hr theory exam (50%)
DP Requirement: Class mark of 40%; Attendance at 80% of lectures, practicals and tutorials and 100% attendance at all assessments

Subminimum to pass: Credit may not be obtained for both BIOL195 and BIOL101. This module is worth 16 degree credits and 16 foundation credits.

Life on Earth (Augmented)

BIOL196 PY WY   (78L-20T-72P-0S-79H-60R-0F-0G-11A-26W-16FC-16DC)

Aim: To develop basic knowledge and understanding of the diversity of organisms, their origin and their importance.

Content: This module is available only to students registered for the BSc4 (Augmented stream). It covers the syllabus of BIOL102 but, in addition, includes a substantial amount of supplementary material and tuition designed for students who are under-prepared for university-level studies to a maximum of 160 hours.

Practicals: Pond diversity, marine inverts, invert body plans, plant adaptations, mosses and ferns, gymnosperms, pollination syndromes, insect morphology and diversity, vertebrates.

Assessment: Tests/assignments (30%), practical reports (20%); 3 h theory exam (50%).

DP Requirement: Class mark of 40%. Attendance at 80% of lectures, practicals and tutorials and 100% attendance at all assessments.

Subminimum to pass: Credit may not be obtained for both BIOL196 and BIOL102. This module carries 16 degree credits and 16 foundation credits.

Biological Sciences Toolkit

BIOL200 P1 W1   (23L-7T-36P-0S-64H-25R-0F-0G-5A-13W-16C)

Prerequisite Requirement: 64C at Level 1.

Prerequisite Modules: BIOL101, 102 and atleast 40% in STAT130.

Aim: To cover, within a biological/ecological context, experimental design, statistical analysis, and scientific writing.

Content: Experimental/Sampling design, hypothesis & prediction generation in biology. Collection & handling of biological data. Statistics as applied to biological problems, summary and interpretation of biological/ecological data. Training in scientific writing related to the above.

Practicals: Hypotheses generation & testing, experimental design, biological data collection, computer based biological data analysis, data interpretation, scientific writing. Particular emphasis on reporting research methods, analyses and interpretation.

Assessment: Tests (20%); practical reports (15%); project (15%); 3 h theory exam (50%).

DP Requirement: 40% Class mark; attendance at 80% of practicals and 100% of tests.

Subminimum to pass: 40% in exam.

Plant and Animal Ecophysiology

BIOL204 P1 W1   (27L-3T-36P-0S-73H-15R-0F-0G-6A-13W-16C)

Prerequisite Requirement: 64C at Level 1.

Prerequisite Modules: BIOL101, 102.

Aim: To provide a basic understanding of major physiological processes of plants and animals, and their relevance, in relation to environmental fluctuations.

Content: Topics from, but not restricted to: Plants: physical environment; growth; photosynthesis; mineral nutrition; water relations; stomatal physiology. Animals: Homeostasis & control theory; thermoregulation; osmoregulation, excretion; circulation; respiration; energy metabolism; endocrinology; nervous system; digestion. Application of key concepts to society.

Practicals: Skills covering the above concepts.

Assessment: Tests (15%), practical assessments, practical reports and scientific reports (35%); 3 h exam (50%).

DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.

Subminimum to pass: 40% in exam. Credit may not be obtained for both BIOL204 and BIOL216.

Vertebrate Biology and Ecology

BIOL210 W1   (27L-9T-36P-0S-68H-15R-0F-0G-5A-15W-16C)

Prerequisite Modules: BIOL102; STAT130.

Aim: To provide graduates with knowledge on vertebrate biology and ecology and their interactions with the environment with emphasis on marine and coastal environments, as well as anatomy and morphology. Skills taught may further include species identification, global change aspects that impact vertebrates in coastal and marine habitats, endemic species to South Africa, life histories, and others.
Content: Vertebrate biodiversity and ecology: suitability of habitats to certain groups, basic knowledge of vertebrate anatomy, morphology and species identification; global change impacts such as climate warming, changed rainfall regimes and effects on vertebrates, poaching and overexploitation of species in habitats they utilise as juveniles and/or adults, their place and role in food webs; life histories of vertebrates; conservation.
Practicals: Dissections of vertebrates (e.g. fish), species identification, various survey methods.
Assessment: Tests (20%), practical reports (30%), exam (50%).
DP Requirement: Class mark of 40%; 80% attendance at all practical sessions.

Plant Diversity and Use
BIOL211 P2   (36L-0T-45P-0S-59H-15R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 64C at Level 1.
Prerequisite Modules: BIOL102.
Aim: To provide an evolutionary framework of the continuity from unicellular organisms through evolution of increasingly complex lifecycles to the explosive radiation of the Anthophyta. To provide skills in plant identification.
Content: Algae. Lichens. Liverworts & mosses. Lower vascular plants. Evolution of seeds; radiation of gymnosperms; key innovations. Origin and radiation of angiosperms, their success and diversification into contemporary families.
Practicals: Characteristic features, identification & recognition of particular plant groups; weekend field trip(s).
Assessment: Tests (20%), assignment(s) (10%) and practical reports (20%); 3 h exam (50%).
DP Requirement: Attendance at 80% of practicals, 100% of tests and field trips; class mark of 40%.
Subminimum to pass: 40% in exam. Students may be required to contribute to the cost of the field trip(s). Credit may not be obtained for both BIOL211 and BIOL212.

Angiosperm Evolution & Diversification
BIOL212 W1   (30L-13T-39P-0S-68H-3R-0F-0G-7A-13W-16C)
Prerequisite Requirement: 64C at Level 1.
Prerequisite Modules: BIOL102.
Aim: To develop understanding of angiosperm evolution & classification using morphological data, DNA analyses, cladistic analyses & the latest fossil finds.
Content: Angiosperm structure & evolution: phylogenetic principles & structural evolution, angiosperm ancestry. Flowering plants as creations of insects & dinosaurs versus ecophysiology innovations. Origin of angiosperm flower, modification & diversification. Angiosperm time & place of origin. Classifications versus cladifications. Current APG classificatory paradigm.
Practicals: Use of diagnostic keys. Prominent & economically important SA flowering plant families.
Assessment: Prac reports (10%), theory tests (25%), practical test (15%), 3h theory exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.
Subminimum to pass: 40% in exam. Credit may not be obtained for both BIOL211 and BIOL212.

Invertebrate Diversity & Conservation
BIOL213 P1   (22L-18T-42P-0S-57H-15R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 64C at Level 1.
Prerequisite Modules: BIOL102.
Aim: To expose students to the diversity of invertebrates through working with them in natural habitats, and to develop the foundations of scientific skills and approaches in the context of exploring invertebrate diversity.
Content: Origin of and evolutionary trends in invertebrates. Classification and diversity. Identification of major groups. Invertebrates and people. Conservation.
Practicals: Sampling strategies for invertebrates. Invertebrate diversity and survival in different habitats (marine, freshwater and terrestrial).

Assessment: Tests (20%), scientific report (15%), assignments (15%), 2 h practical test (15%); 3 h theory exam (35%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.
Subminimum to pass: 40% in exam. Credit may not be obtained for both BIOL213 and BIOL214.

Invertebrate Diversity & Ecology

BIOL214 W1   (27L-9T-36P-0S-68H-15R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 64C at Level 1.
Prerequisite Modules: BIOL102.
Aim: To introduce the diversity and ecological significance of the dominant invertebrates in marine and terrestrial habitats.
Content: Origin of and evolutionary trends in invertebrates. Invertebrate classification and diversity. Identification of major groups of invertebrates, with emphasis on marine phyla including an introduction to protozoans. Ecological importance of dominant marine and terrestrial taxa, emphasising their habitat, mode of feeding, and role in food-web processes.
Practicals: Field or laboratory assignments as designated by the module coordinator.
Assessment: Practical assignments and reports (30%), class tests (20%); 3 h theory exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and tutorials and 100% of tests.
Subminimum to pass: 40% in exam. Credit may not be obtained for both BIOL214 and BIOL213.

Vertebrate Biology

BIOL222 P2   (31L-5T-48P-0S-55H-15R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 64C at Level 1.
Prerequisite Modules: BIOL102.
Aim: To enable students to acquire an understanding of the relationships and comparative biology of vertebrate animals. **Content:** Classification, origin and evolution, anatomy and physiology, adaptive radiation and adaptation, life histories, behaviour, ecology, demography and social organisation of fishes, amphibians, reptiles, birds and mammals.
Practicals: Use of identification keys, dissection, biological illustration, life tables, census, capture mark-and-release, mist-netting and ringing, small-mammal trapping, scientific writing in an integrated comparative style.
Assessment: Theory & practical tests (25%), practical reports (25%); 3 h theory exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.
Subminimum to pass: 40% in exam.

Rangeland Plants: Ecology and Management

BIOL223 P1   (27L-9T-36P-0S-68H-15R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 64C at Level 1.
Prerequisite Modules: BIOL102.
Aim: To introduce the principles of rangeland ecology and management in conservation, game ranching, agricultural & communal systems. To develop expertise in rangeland research techniques.
Content: Key ecological principles and applications in range & wildlife management. Responses of grasses to defoliation, grazing systems, veld condition, fodder flow management, ecological & production characteristics of livestock systems, veld burning, rangeland monitoring techniques.
Practicals: Assessment of veld condition & forage quality. Field visits. Identification & collection of grass & tree species.
Microscope techniques, keys for plant identification.
Assessment: Tests (20%), assignments (10%), practical reports (20%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.
Subminimum to pass: 40% in exam.

Marine Environment

BIOL231 W2   (27L-9T-36P-0S-68H-15R-0F-0G-5A-13W-16C)

Prerequisite Requirement: 64C at Level 1.
Prerequisite Modules: MATH150, BIOL102
Aim: To introduce the geological, chemical, physical & biological processes of the marine environment.
Content: Geological: geological environments, sediments. Chemical: seawater, macronutrients, trace elements, dissolved gases, nitrogen cycle. Physical: circulation patterns, upwelling, tides, waves, near-shore currents, vertical processes. Biological: light and primary production, food webs, benthic/pelagic subsystems, functional ecosystems.
Practicals: Measurement of sediment grain size characteristics, flow rates, salinity, temperature, dissolved oxygen, microalgal biomass and biological community structure.
Assessment: Course work, practical exercises and tests (50%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals, 100% of tests and field trips.
Subminimum to pass: 40% in exam.

Immune Systems
BIOL233 W2   (27L-9T-36P-0S-68H-15R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 64C at Level 1.
Prerequisite Modules: BIOL101, 102.
Aim: To introduce immunology & the functioning of the immune system, relating it to both cellular and molecular biology, but placing it in the context of vertebrate systems.
Content: Anatomy of the immune system. Haematopoetic tissue. Lymphocyte populations. Innate immunity. Adaptive immunity: generation of B-cell and T-cell diversity- genetic control of antibody diversity, antibody-antigen interactions. Histocompatibility & human diversity, transplant rejection. Hypersensitivity, HIV and AIDS, autoimmune dysfunction. Alternative immune systems (invertebrates and cyclostomes).
Practicals: Appropriate to the above.
Assessment: Tests (15%), tutorials (10%), practicals (10%), essay (15%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.
Subminimum to pass: 40% in exam.

Cytology & Cellular Biology
BIOL234 W2   (29L-9T-36P-8S-56H-15R-0F-0G-7A-13W-16C)
Prerequisite Requirement: 64C at Level 1.
Prerequisite Modules: BIOL101, 102.
Aim: To introduce the science of cell structure and function.
Content: Theory and use of light and electron microscopy; cell walls, cellulose biosynthesis and specialization; the endomembrane and cytoskeletal systems; organelles; cell communication and signalling, ultrastructural morphology and functions of secretory tissues.
Practicals: Introduction to the principle and practice of light and electronmicroscopy; application of histo- and cytochemical tests to plant and animal cells. Histology.
Assessment: Assignment (10%), Theory test (15%), Practical test (15%), Practical reports (10%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.
Subminimum to pass: 40% in exam.

Professional Communication for Biologists
BIOL300 P2 W1   (7L-23T-3P-10S-117H-0R-0F-0G-0A-13W-16C)
Prerequisite Requirement: 64C at Level 2 including 32C BIOL at Level 2.
Prerequisite Modules: STAT130 or BIOL200.
Aim: To train students to contextualise, critically evaluate, synthesise & express biological information and concepts for a range of audiences.
Content: A sequence of iterative tasks focussing on a particular topic designed to develop core competencies required for the study of biology & its component disciplines. Particular emphasis on skills relating to contextualising, critically evaluating, synthesising & expressing biological information & concepts so that they can be effectively communicated to a range of audiences.
Assessment: Literature review paper (70%), assignment (30%).

DP Requirement: Not applicable.

Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam. Available only to students registered for a qualification for which the module is core.

Evolution and Systematics

BIOL304 P2 W2   (27L-5T-39P-0S-68H-16R-0F-0G-5A-13W-16C)

Prerequisite Requirement: 64C at Level 2.

Prerequisite Modules: BIOL200, (RDNA202 or GENE240)

Aim: To understand the processes of evolution, modern debates in evolutionary biology, phylogenetic estimation and biological systematics.

Content: Evolutionary thinking. Microevolution. Species concepts and speciation, Classification systems. Molecular evolution. Phylogenetic estimation. Molecular systematics. Topics from: natural selection; adaptation; convergence; coevolution and mimicry; adaptive radiation; primate evolution; gradualism; neutralism; chromosomal, protein and DNA variation; nomenclature.

Practicals: Selected from the topics above.

Assessment: Review essay (15%), Test (15%), Practical reports (20%); 3 h exam (50%).

DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.

 Subminimum to pass: 40% in exam.

Population and Community Ecology

BIOL305 P1 W1   (30L-6T-36P-30S-37H-16R-0F-0G-5A-13W-16C)

Prerequisite Requirement: 64C at Level 2.

Prerequisite Modules: BIOL200.

Aim: To introduce principles and concepts of population and community ecology, and their application, in relation to single-species populations, metapopulations and communities.

Content: Determinants of species distributions and abundances. Population demography, growth models, competition, predation, parasitism. Community patterns, food webs, species-area relationships; island biogeography; equilibrium & non-equilibrium models of diversity.

Practicals: Field trips & computer-based exercises. Skills covering the above concepts, including matrix models, measuring biodiversity, diversity indices, competition & predation, succession models.

Assessment: Tests (20%), practical & field-trip reports (20%), research-paper review (5%), seminar (5%); 3 h exam (50%).

DP Requirement: Class Mark of 40%; attendance at 80% of practicals and 100% of tests and field trips.

Subminimum to pass: 40% in exam. Students will be required to contribute to the costs of the field trip(s).

Practical Research Skills in Marine Biology

BIOL310 W1   (9L-18T-27P-0S-46H-18R-36F-0G-6A-15W-16C)

Prerequisite Modules: BIOL200, 231

Aim: To provide graduates with a specialised, practical, in-depth knowledge of research methods in marine biology. The use of field sampling equipment and techniques, pertinent laboratory techniques to process samples, aquariology, marine invertebrate and fish husbandry, experimental design, data organisation and storage. Basic boat skills may also be included.

Content: Planning a project that required field work; rocky shore, sandy beach and estuary sampling and survey techniques offshore sampling techniques and equipment; animal husbandry; laboratory techniques for processing and analysing samples; data recording, organisation and storage.

Practicals: Field trips to acquaint student with practical research problems and techniques will be an integral part of the course. 42 Hours will be allocated for a combination of day-trips and overnight trips. Practicals are designed to acquaint students with laboratory and aquarium techniques.

Assessment: Class record, composed of written and oral assignments, including fieldwork and a test (50%). A final exam will comprise 50% of the module mark

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DP Requirement: Class mark of 40%, 80% attendance at all practical sessions.
(BIOL310 is not available in 2020 but will be available only in 2021)

Applied Biotechnology
BIOL315 P2   (29L-10T-36P-5S-59H-16R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 64C at Level 2.
Prerequisite Modules: BIOL101.
Aim: To introduce students to the principles of plant bio- and molecular technology and their applications (in agriculture and industry).
Content: Principles of gene cloning. Plasmid vector selection. Transformation techniques. Gene location and structure. Gene transfer and analysis. Cell culture. Manipulation of growth and development *in vitro*. Emphasis is placed on the relevance of biotechnology in modern society.
Assessment: Tests (10%), assignment (10%), practical reports (20%), seminar (10%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.
Subminimum to pass: 40% in exam. Credit may not be obtained for both BIOL315 and BIOL316.

Animal and Plant Biotechnology
BIOL316 W2   (36L-33T-3P-20S-47H-16R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 64C at Level 2 including 32C BIOL modules.
Prerequisite Modules: (BIOL200 or STAT130); RDNA202.
Aim: To introduce students to the basic concepts of genetic engineering and biotechnology and their applications to the fields of agriculture, forestry, animal husbandry, medicine, forensics, etc.
Content: Ancient, classical and modern biotechnology. Classical studies on cloning. Basic principles of recombinantDNA technology. Gene transfer methods in animals and plants. Topics plant and animal biotechnology. Biotechnology and forensics. Regulations, patents and society.
Assessment: Tests (25%), tutorial assignments (10%), poster (15%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at 100% of tests.
Subminimum to pass: 40% in exam. Credit may not be obtained for both BIOL316 and BIOL315.

Plant Growth and Development
BIOL321 P1   (29L-10T-36P-0S-64H-16R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 64C at Level 2.
Prerequisite Modules: BIOL101, 102.
Aim: To provide understanding of scientific principles with respect to biotic and abiotic factors that play a role in correlative processes.
Content: Scientific principles with respect to biotic and abiotic factors that play a role in correlative processes such as germination, juvenility, rooting, apical dominance, flowering, senescence, abscission and plant movements.
Assessment: Tests (20%), assignments (10%), practical reports (20%); 3 h theory exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.
Subminimum to pass: 40% in exam.

Insect Diversity and Evolution
BIOL322 P1   (30L-9T-36P-0S-63H-16R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 64C at Level 2.
Prerequisite Modules: BIOL102.
Aim: To develop an understanding of the evolutionary relationships of insects, their diversity, comparative biology and relevance to human society.
Content: Functional morphology and ontogenetic systems of insects; life histories, ecological interactions, biological requirements, biotic significance and classification of important families of all orders of insects, emphasising evolutionary relationships, adaptations and relevance to human society.

Assessment: Practical reports and tests (10%), theory tests (20%), insect collection (20%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests. Submission of insect collection.
Subminimum to pass 40% in exam.

Advanced Rangeland Ecology
BIOL323 P1 (27L-12T-36P-0S-64H-16R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 64C at Level 2 including 32C BIOL.
Prerequisite Modules: (BIOL200 or STAT130), BIOL223.
Aim: To provide a grounding in applied rangeland ecology & objective-based management.
Content: Determinants of community composition in natural and transformed rangelands; the roles of disturbance and competition for resources. Productivity, carrying capacity, stocking rates, secondary productivity in complex, dynamic interactive systems. Management & rehabilitation of vegetation types to achieve particular outcomes. Historical & contemporary theories of rangeland function.
Practicals: Manipulative experiments to examine determinants of community composition; long-term ecological trials; transformed rangelands; weekend field trip.
Assessment: Practical reports (10%), assignment (20%), class tests and spot tests (20%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals, 100% of tests and field trips.
Subminimum to pass: 40% in exam. Students may be required to contribute to the cost of the field trip(s).

Evolutionary Animal Physiology
BIOL324 P1 (27L-3T-36P-0S-73H-16R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 64C at Level 2 including 32C BIOL.
Prerequisite Modules: BIOL200 or STAT130.
Aim: To explore the evolution of physiological diversity and adaptation, following the theme of tracing the fate of energy from the environment to offspring.
Content: Environmental resource availability, gross energy of consumption, metabolizable energy, maintenance energy, net energy, production energy, reproductive energy, energetic basis of fitness, physiological adaptation.
Practicals: Mammalian digestive systems, rumen morphology and physiology, bomb calorimetry, respirometry, telemetric systems, analysis of energetic data, the comparative method, quantitative genetics of energetic parameters, analysis of life-history data.
Assessment: Scientific papers (25%), tests (25%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.
Subminimum to pass: 40% in exam.

Reproductive & Behavioural Ecology
BIOL325 P2 (30L-5T-46P-0S-58H-16R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 64C at Level 2 including 32C BIOL.
Prerequisite Modules: BIOL200 or STAT130.
Aim: To develop an understanding of evolutionary ecology. To encourage critical thought and the ability to construct and test hypotheses in evolutionary ecology.
Content: Introduction to evolutionary ecology. Reproductive ecology: concept of sexual selection, reproductive ecology in animals (including sociality), reproductive ecology in plants. Foraging theory: animals, plant defence strategies. Coevolution.
Practicals: 10 laboratory exercises and a weekend field trip.
Assessment: Theory tests and spot tests (20%), prac reports (12%), mini-project report (18%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals, 100% of tests and field trip.
Subminimum to pass: 40% in exam. Students may be required to contribute to the cost of the field trip.

Marine Systems
BIOL341 W1 (27L-10T-50P-0S-52H-16R-0F-0G-5A-13W-16C)

Prerequisite Requirement: 64C at Level 2 including 32C BIOL.
Prerequisite Modules: BIOL200 or STAT130.
Aim: To contextualise interactions among marine organisms and between these organisms and their environment, emphasising that many marine ecosystem services vital to the global biosphere emerge only at the ecosystem level.
Content: The Earth as a system. Overviews of marine systems, their ecosystem processes and their future. Ocean systems in relation to biogeochemical cycles, climate and humanity from a local to global perspective.
Practicals: Selected from the topics above, including group work and field trip(s).
Assessment: Practical reports (20%), class tests and/or spot tests (30%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at field trip, 80% of other practicals, 100% of tests.
Subminimum to pass: 40% in exam. Students will be required to contribute to the costs of the field trip(s).
Entry to BIOL341 is restricted to students registered for the BSc Marine Biology Programme, and for the BSc Biological Sciences Programme.

Marine Ecophysiology
BIOL342 W2   (27L-9T-36P-0S-67H-16R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 64C at Level 2 including 32C BIOL modules.
Prerequisite Modules: (BIOL200 or STAT130); BIOL204.
Aim: To focus on the physiological functioning of animals, algae and plants in relation to the marine environment.
Content: Animals: feeding, growth and production; respiration and diving mammals; water density and strategies used to achieve neutral buoyancy; osmotic regulation in marine vertebrates and invertebrates; nitrogen excretion and utilisation. Algae and plants: effects of light intensity and quality, temperature, salinity, nutrient status, pigments, osmotic balance on growth, stress and production.
Practicals: Selected from the topics above.
Assessment: Practical reports (26%), class tests (24%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.
Subminimum to pass: 40% in exam.

Applied Marine Biology
BIOL343 W2   (29L-9T-36P-0S-65H-16R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 64C at Level 2.
Prerequisite Modules: BIOL200, 231.
Aim: To provide students with an understanding of practical and conceptual applications of marine biological principles. **Content:** Concepts and applications, including mariculture and biotechnology, marine pollution, impacts on coastal ecosystems and quantitative assessment of ecological effects, fisheries science and modelling.
Practicals: Selected from the topics above. Field trip(s).
Assessment: Assignments (50%); 3 h theory exam (50%).
DP Requirement: Attendance at 80% of practicals, 100% of tests and field trips. 40% Class mark.
Subminimum to pass: 40% in exam. Students may be required to contribute to the cost of the field trip(s).
Entry to BIOL343 is restricted to students registered for the BSc Marine Biology Programme, and for the BSc Biological Sciences Programme.

Parasites and People
BIOL344 W1   (29L-18T-18P-0S-73H-16R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 64C at Level 2.
Prerequisite Modules: BIOL101, 102.
Aim: To survey animals that cause parasitic disease in people in South Africa, to identify those of public-health importance and to discuss measures to control them.
Content: Animals that cause parasitic disease in people in South Africa: morphology and life-cycles, modes-oftransmission, effects, epidemiology, species of public-health importance (morbidity, burdens of disease, influence of water-resource developments on disease transmission, control programmes, drugs and drug resistance, insecticides, molluscicides, parasites and AIDS).

Practicals: Selected from the topics above.

Assessment: Practical write-ups (10%), tests (10%), essay (15%, externally examined), practical test (15%); 3 h theory exam (50%).

DP Requirement: Class marks of 40%. Submission of an essay is compulsory, attendance at 100% of practicals and tests.

Subminimum to pass 40% in exam.

Functional Cell Architecture

BIOL345 W1   (27L-18T-39P-0S-52H-16R-0F-0G-8A-13W-16C)

Prerequisite Requirement: 64C at Level 2.

Prerequisite Modules: RDNA202.

Aim: To provide an overview of structure, function and coordination at the subcellular, cellular and tissue levels in plants and animals.

Content: Membrane structure and function. Properties & biophysics of intracellular water. Intracellular spatial organization. The cytoskeleton. The endomembrane system. Intra- and extracellular coordination. Theory of light microscopy. Theory of scanning and transmission electron microscopy.

Practicals: Selected from topics above.

Assessment: Theory tests (35%); practical write-ups (15%); 3 h theory exam (50%).

DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.

Subminimum to pass: 40% in the exam.

Pollution and Remediation Biology

BIOL347 W1   (29L-9T-36P-0S-65H-16R-0F-0G-5A-13W-16C)

Prerequisite Requirement: 64C at Level 2 including 32C BIOL.

Prerequisite Modules: BIOL200 or STAT130.

Aim: To apply theoretical concepts from cellular biology to contemporary environmental problems involving pollution.

Content: Basic principles of pollution, ecotoxicology and remediation. These include: (1) the nature, sources and ultimate fate of pollutants, (2) the effect of pollutants on all levels of organization, including biochemical, cellular, whole organism, populations, communities and ecosystems, and (3) remediation of polluted ecosystems.

Practicals: Preparation and presentation of a scientific poster. Mini-project on a topic selected from above content.

Assessment: Class and spot tests (25%), Tutorial Exercises (5%), Practcals (20%), 3 h Exam (50%).

DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.

Subminimum to pass: 40% in exam.

Applied Plant Physiology

BIOL348 W2   (28L-0T-39P-0S-72H-16R-0F-0G-5A-13W-16C)

Prerequisite Requirement: 64C at Level 2 including 32C BIOL.

Prerequisite Modules: (BIOL200 or STAT222); BIOL204.

Aim: To illustrate the importance of whole-plant physiology in the growth and performance of plants in natural and managed ecosystems.

Content: Advanced plant water relations: pressure-volume curves; transpiration; modelling of evapotranspiration; hydraulic characteristics. Photosynthesis: response of assimilation to intercellular CO_2; stomatal limitations; water-use efficiency; introduction to chlorophyll fluorescence. Stress physiology: responses of plants to environmental stresses; stress resistance; determinants of plant growth & productivity.

Practicals: Modern techniques in plant ecophysiology; mini-project.

Assessment: Reports on practical exercises (30%), tests (20%); 3 h exam (50%).

DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.

Subminimum to pass: 40% in exam.

Seeds and Vegetative Propagation
BIOL349 W1   (29L-15T-36P-0S-58H-16R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 64C at Level 2 including 32C BIOL.
Prerequisite Modules: (BIOL200 or STAT130); BIOL212
Aim: To provide students with an insight into the theoretical information and practical skills relevant to this applied field of plant sciences.
Content: Seed structure and development, water in seeds, orthodox and recalcitrant/non-orthodox seeds. Traditional and modern approaches to plant propagation and breeding (e.g. macro- and micropropagation, *in vitro* cultures) and germplasm conservation. Applications to agriculture, forestry and conservation.
Practicals: Selected exercises from the topics above.
Assessment: Tests (25%), practical write-ups (12.5%), tutorials (12.5%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.
Subminimum to pass: 40% in exam.

Developmental Biology
BIOL350 W2   (29L-9T-33P-6S-62H-16R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 64C at Level 2 including 32C BIOL modules.
Prerequisite Modules: (BIOL200 or STAT130); RDNA202.
Aim: To provide an overview of core concepts & principles of Developmental Biology and their application to society.
Content: Topics selected from, but not restricted to: Gametogenesis, from sperm to egg to embryo, germ cells, genetic regulation of development, organizing the multicellular embryo (morphogensis), generating cell diversity (Hox genes, cell determination & differentiation, programmed cell death). Application of selected key concepts to society, including: Reproductive (fertility) technology, development & cancer.
Practicals: Cell culture, fertilization & early development in the sea urchin & chick, environmental effects on development.
Assessment: Practical reports (10%), Seminar (15%), Tests (25%); 3 h exam (50%).
DP Requirement: Class marks of 40%. Attendance at 80% of practicals and 100% of tests.
Subminimum to pass: 40% in exam.

Biology/Ecology Research Project
BIOL390 PB WB   (0L-6T-98P-0S-56H-0R-0F-0G-0A-13W-16C)
Prerequisite Requirement: 96C at Level 2 including 48C BIOL.
Prerequisite Modules: BIOL200 or STAT130.
Aim: To introduce students to independent research in biological and/or ecological sciences, thereby improving their problem-solving abilities, and increasing their interest in and enthusiasm for the subject matter.
Content: Conception, design, execution and reporting of a small independent research project chosen from a list appropriate to the student's qualification/specialisation (as approved by the Academic Coordinator) and supervised by individual staff members.
Assessment: Performance and attitudes (30%), project write-up (draft (20%), final (50%, externally examined)).
DP Requirement: Not applicable.
Offered in Semester 1 and 2. Subminimum to pass: 50% in project write-up. This module has no supplementary exam. 96C at Level 2 including 48C BIOL. Entry to this module will be dependent on being registered for a programme or major in Biology.

Marine Biology Research Project
BIOL391 WB   (0L-6T-98P-0S-56H-0R-0F-0G-0A-13W-16C)
Prerequisite Requirement: 96C at Level 2 including 48C BIOL.
Prerequisite Modules: BIOL200 or STAT130.
Aim: To introduce students to independent research in Marine Biology, thereby improving their problem-solving abilities, and increasing their interest in and enthusiasm for the subject matter.

Content: Conception, design, execution and reporting of a small independent research project chosen from a list appropriate to Marine Biology (as approved by the School) and supervised by individual staff members.
Assessment: Performance and attitudes (30%), project write-up (draft (20%), final (50%, externally examined)).
DP Requirement: Not applicable.
Offered in Semester 1 and 2. Subminimum to pass: 50% in project write-up. This module has no supplementary exam. Available only to students registered for the Marine Biology Programme.

Biology/Ecology Tools and Skills
BIOL701 P1 W1   (36L-36T-36P-10S-42H-0R-0F-0G-0A-6W-16C)
Prerequisite Requirement: 64C at Level 3 in biological and/or ecological sciences.
Aim: To provide skills for planning, implementing, analyzing and interpreting research in ecology and biology.
Content: Two compulsory sections are (a) Introduction to the philosophy of biology, and (b) Introduction to statistical analysis for biological research. The remainder will be skills-based options decided in consultation with academic staff, including advanced biological statistics (multivariate techniques), electron microscopy, bioinformatics, radiochemistry, museum techniques, botanical techniques, GIS, ecological field techniques.
Practicals: As appropriate. Compulsory 3 day field trip.
Assessment: Continuous (100%); exercises comprising at least 50% of the final mark externally examined.
DP Requirement: Not applicable.
Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam.

Coastal Ecology
BIOL702 WC   (6L-18T-0P-16S-115H-2R-0F-0G-3A-7W-16C)
Prerequisite Requirement: 48C at Level 3 in relevant biological sciences, or permission of Dean.
Aim: To investigate in depth selected aspects relating to the nature of the South African coastal environment, plant and animal adaptations, ecosystem function and coastal management.
Content: Theoretical and practical study of the biologically relevant components of South Africa's coastal environment, including physiological and behavioural adaptations of the coastal flora and fauna, ecosystem function and coastal management.
Assessment: Review (50%), Field data report (30%), Oral presentation (15%), test (5%).
DP Requirement: Not applicable.
Offered in either Semester 1 or 2. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam.

Parasitology
BIOL712 WC   (0L-30T-0P-0S-130H-0R-0F-0G-0A-7W-16C)
Prerequisite Modules: BIOL344.
Aim: To provide an overview of some of the aspects of parasitology, notably in the biomedical field, that are currently being debated in the literature.
Content: A selection of three topics that are of current interest to medical parasitologists worldwide. These topics may change from year to year. Examples are: host manipulation by parasites, emerging diseases, drug and insecticide resistance in parasites and arthropod vectors respectively, the DDT dilemma in malaria control, the use of GIS in controlprogramme planning. Weekly tutorials to discuss issues arising from the assignments.
Assessment: Continuous (100%); exercises comprising at least 50% of the final mark externally examined.
DP Requirement: Not applicable.
Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam.

Molecular Ecology and Systematics
BIOL715 WC   (7L-39T-0P-14S-100H-0R-0F-0G-0A-7W-16C)

Aim: To introduce students to basic concepts of molecular systematics, bioinformatics, phylogeography and conservation genetics.

Content: DNA sequence editing and alignment. Methods used to infer phylogenies (parsimony, maximum likelihood, neighbour-joining, Bayesian inference). Phylogeography (haplotype networks). Conservation genetics. Basic bioinformatics; sequence retrieval from internet-based sequence databases. The mode of delivery will include lectures, tutorials, seminar presentations by students, and hands-on computer-based bioinformatics tutorials.

Assessment: Seminar (20%), essay (30%), bioinformatics project (50%, externally examined).

DP Requirement: Not applicable.

Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined component. This module has no supplementary exam.

Plant Ecophysiology

BIOL716 WC   (0L-30T-0P-0S-130H-0R-0F-0G-0A-7W-16C)

Prerequisite Requirement: 64C at Level 3 in biological sciences.

Aim: To illustrate the importance of whole-plant physiology in the growth and performance of plants in natural and managed ecosystems.

Content: Tailored to suit the interests of the participants. Key fields followed by case studies. Key fields include: determinants of plant growth, plant-water relations and photosynthesis. Selected aspects of plant stress physiology in the context of plant responses to various climate change scenarios, e.g. increase in temperature, elevated atmospheric CO_2 concentrations, intensified competition between indigenous & alien invasive species, extended drought & flash flooding.

Assessment: Continuous (100%); exercises comprising at least 50% of the final mark externally examined.

DP Requirement: Not applicable.

Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam.

Rangeland Ecology: Soil/Plant Interactions

BIOL722 PC   (12L-36T-20P-10S-82H-0R-0F-0G-0A-7W-16C)

Prerequisite Requirement: 48C at Level 3 in biological sciences.

Aim: To consolidate knowledge of important specialist topics in range and wildlife science in the soil/plant continuum.

Content: Choice of four specialist topics in consultation with staff. Topics include resource degradation, principles of rehabilitation, revegetation, management to arrest and reverse degradation for sustainability of commercial livestock, communal livestock and game-ranching systems. Review of papers and synthesis of literature interspersed with tutorial discussions.

Practicals: Field trip(s) to appropriate locations.

Assessment: Assignments (20%), seminars (20%), reports (60%, externally examined).

DP Requirement: Not applicable.

Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam. Students may be required to contribute to the cost of the field trip(s).

Rangeland Ecology: Plant/Animal Interactions

BIOL723 PC   (12L-36T-20P-10S-82H-0R-0F-0G-0A-7W-16C)

Prerequisite Requirement: 48C at Level 3 in biological sciences.

Aim: To consolidate knowledge of important specialist topics in range and wildlife science in the plant/animal continuum. **Content:** Choice of specialist topics in consultation with staff. Topics focus on plant-animal interactions with emphasis on grazing and browsing behaviour, patterns, impacts and management for domestic livestock under different management systems and wild herbivores in game ranching and conservation systems. Review of papers and synthesis of literature interspersed with tutorial discussions.

Practicals: Field trip(s) to appropriate locations, collection, analysis and synthesis of data.

Assessment: Mini-project (15%), seminars/workshop (25%), report (60% externally examined).

DP Requirement: Not applicable.

Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam. Students may be required to contribute to the cost of the field trip(s).

Conservation Ecology

BIOL724 PC   (15L-8T-25P-10S-82H-10R-0F-10G-0A-7W-16C)

Prerequisite Requirement: 48C at Level 3 in biological sciences.

Aim: To provide students with an understanding of conservation problems ranging from small populations to ecosystems, and the tools and skills required for managing these.

Content: Factors creating small populations, biological implications, and strategies for managing small populations. Case studies of small populations and metapopulations. Experimental approaches to conservation. Holistic conservation at the landscape level.

Practicals: Analysis and interpretation of population data, interpretation of other data.

Assessment: Practical reports (30%), seminars and/or debates (20%), assignments (50%, externally examined).

DP Requirement: Not applicable.

Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam.

Insects and Alien-Plant Control

BIOL726 PC   (10L-14T-36P-0S-100H-0R-0F-0G-0A-7W-16C)

Prerequisite Requirement: 48C at Level 3 in biological sciences.

Aim: To provide an understanding of biological invasions and the management of alien invasive plants, in particular the initiation and management of a biological-control programme against an alien weed.

Content: Theory and practice of biological weed control in the context of integrated weed management. Targeting a weed for biological control. Analyzing the risks of releasing a new biological-control agent. Motivation, design and budgeting of a research programme targeting a new weed for biological-control.

Practicals: Trips to field sites & research organisations.

Assessment: Practical reports and assignments (60%, half externally examined), research-design report (40%, externally examined).

DP Requirement: Not applicable.

Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam. Students may be required to contribute to the cost of the field trips.

Plant Breeding Systems

BIOL733 PC   (16L-4T-7P-13S-107H-10R-0F-0G-3A-7W-16C)

Prerequisite Requirement: 48C at Level 3 in biological sciences.

Aim: To develop an understanding of plant breeding systems.

Content: Sexual versus asexual reproduction, outbreeding versus selfing, self-incompatibility mechanisms, heteromorphy, sex expression, determinants of seed production, evolutionary trends, ecological consequences of breeding systems for rarity and colonization ability, mating-system analysis.

Practicals: Controlled hand-pollination experiments.

Assessment: Continuous: Seminar (25%), essay (25%); final test (50%, externally examined).

DP Requirement: Not applicable.

Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary examination.

Plant Biosystematics

BIOL734 PC   (0L-20T-48P-0S-92H-0R-0F-0G-0A-7W-16C)

Prerequisite Requirement: 48C at Level 3 in biological sciences.

Prerequisite Modules: BIOL211 or BIOL212, and BIOL 304, or related module in biosystematics.
Aim: To introduce students to advanced aspects of plant biosystematics.
Content: Plant biodiversity, nomenclature and classification, morphological and/or molecular systematics, herbarium managemenet, e-taxonomy and plant database resources, and evolutionary plant biogeography.
Practicals: Field trip(s) and herbarium assignments.
Assessment: Continuous Assignment (75%), essay and/or seminar (25%), (50% externally examined)
DP Requirement: Not applicable.
Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined component. This module has no supplementary examination. Students may be required to contribute to the costs of the field trip.

Biodiversity Patterns and Dynamics
BIOL735 WC   (16L-4T-7P-13S-107H-10R-0F-0G-3A-7W-16C)
Prerequisite Requirement: 64C at Level 3 in biological or agricultural sciences.
Aim: To gain understanding of some of the most recent findings & issues involving the patterns and dynamics of terrestrial and marine biodiversity, through measurement, analysis and interpretation of current and future data and critical review and analysis of current literature.
Content: Biological classification, species concepts, patterns and dynamics/factors of diversity, scaling effects, interspecific interactions including assembly rules in community ecology, biogeography, and international and local conventions for the protection of biodiversity. Emphasis will be on southern Africa. **Practicals:** Controlled hand-pollination experiments.
Assessment: Seminar (25%), essay (25%); final test (50%, externally examined).
DP Requirement: Not applicable.
Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary examination.

Plant Biosystematics and Ultrastructure
BIOL738 W2   (0L-15T-66P-14S-62H-0R-0F-0G-3A-7W-16C)
Prerequisite Requirement: First degree of 48C of which must be in plant orientated modules.
Aim: To introduce advanced plant biosystematics from cellular to species levels
Content: A common seminar is undertaken, followed by an assignment on secretory structures or phytochemical uses in important southern African medicinal plants. The plant biodiversity/biosystematics assignment is an informatics presentation. The module is concluded by the construction of a webpage that draws together the entire module. A 3day weekend fieldtrip is included. Studies will involve use of state-of-the-art equipment in electron microscopy.
Practicals: Visits to research facilities in the greater Durban/Pietermaritzburg areas.
Assessment: Seminar (30%), portfolio (10%), assignments (60%). At least 50% is externally examined.
DP Requirement: Not applicable.
Module offered in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam.

Biochem-Plasticity in Changing Environments
BIOL742 WC   (0L-28T-12P-6S-111H-0R-0F-0G-3A-7W-16C)
Prerequisite Requirement: 96C at Level 3 in the Biological and/or Environmental sciences.
Aim: To provide an overview of how specific biochemical processes allow or limit organisms to cope with changes in their environment.
Content: Topics selected from, but not restricted to: Cellular metabolism, regulation and homeostasis; regulating the internal milleu during changes in temperature, oxygen availability (anoxic, hypoxic and hyperoxic environments; adaptation to high altitudes, diving, exercise), or exposure to polluted environments; practical applications of above topics.
Assessment: Continuous: seminars (20%), practical report (20%), assignment (60%, externally examined).
DP Requirement: Not applicable.

Module offered in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components.
This module has no supplementary exam.

Plant Biotechnology
BIOL747 WC   (0L-30T-0P-0S-94H-36R-0F-0G-0A-7W-16C)
Prerequisite Requirement: 32C at Level 3 in plant sciences.
Aim: To investigate, discuss and debate the methodologies, applications and risks of plant tissue culture, genetic engineering and other plant biotechnologies.
Content: Various *in vitro* culture systems, cryopreservation and genetic engineering. Emphasis will be on applications to crop improvement, food production and conservation, public perceptions, risk assessment and patents. Efforts will be directed at including up-to-date topics and technologies as new developments occur.
Assessment: Presentations on selected topics (40%), exercise based on published paper(s) (20%), assignment (40%).
DP Requirement: Not applicable.
Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam.

Desiccation, Cryobiology and Cryoconservation
BIOL751 WC   (0L-30T-0P-0S-127H-0R-0F-0G-3A-7W-16C)
Prerequisite Requirement: 48C at level 3 in the Biological Sciences.
Prerequisite Modules: BIOL234, 316 or 345.
Aim: To appreciate the implications of desiccation-sensitivity and -tolerance in the context of conventional storage and long-term cryoconservation of plant germplasm.
Content: Exploration of pivotal literature and current research on the basis of desiccation sensitivity and tolerance in seeds and vegetative plant tissues and how key characteristics impact broadly on germplasm conservation. Consideration of water in cells and the biophysics of drying and freezing; applications of cryobiology; procedures to optimise specimen recovery; *in vitro* practices; retention of genetic and phenotypic fidelity.
Assessment: Continuous (100%); exercises comprising at least 50% of the final mark externally examined.
DP Requirement: Not applicable.
Module taught in the semester prescribed in the Honours handbook. Subminimum to pass: 40% minimum in each component. This module has no supplementary exam.

Advanced Plant Physiology
BIOL763 PC   (30L-10T-0P-10S-95H-10R-0F-0G-5A-6W-16C)
Prerequisite Requirement: 48C at Level 3 in biological sciences.
Aim: To provide in-depth insight into how plants function at cellular, tissue and organ levels. Traditional medicine and phytochemistry.
Content: Emphasis on the relevance of biotechnology in modern society. Secondary metabolites. Traditional medicine and phytochemistry. Trade in medicinal plants. Biotechnology and medicinal plants. Impact of environmental stress on plant growth and crop production.
Practicals: Hormone extraction and manipulation. Secondary-metabolite extraction and identification.
Assessment: Tests, assignments and seminars (50%), final test (50%).
DP Requirement: Not applicable.
Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam.

Terrestrial African Vertebrate Zoology
BIOL764 PC   (10L-20T-50P-15S-40H-0R-0F-20G-5A-7W-16C)
Prerequisite Requirement: 48C at Level 3 in biological sciences.

Aim: To educate and train learners in selected aspects of terrestrial African vertebrate zoology depending on staff particular specialist topics. These will include one or more of the following taxa amphibians, reptilians, birds and/or mammals.

Content: Selected aspects of terrestrial African vertebrate zoology, including one or more of the following taxa: amphibians, reptilians, birds, mammals. Topics may include one or more of the following: evolution, physiology, biogeography, ecology, conservation.

Practicals: Field Trips. Hormone extraction and manipulation. Secondary-metabolite extraction and identification.

Assessment: Continuous (100%); exercises comprising at least 50% of the final mark externally examined.

DP Requirement: Not applicable.

Subminimum to pass: 50% weighted average in externally examined components. Module taught in the semester prescribed in the honours handbook. This module has no supplementary exam.

Fisheries Science

BIOL782 WC   (0L-49T-0P-0S-63H-18R-0F-30G-0A-7W-16C)

Prerequisite Requirement: 64C at Level 3 in biological sciences, of which 32C or equivalent must be in Aquatic/Marine topics.

Aim: To provide students with the basic concepts of marine-resource stock assessment, and the nature of fisheries in South Africa, and to expose them to some standard fishery analyses.

Content: Introduction to the theory of fisheries stock assessment and practical assessment modelling. Synopses of fisheries sectors, and fisheries analyses.

Practicals: Catch Per Unit Effort (CPUE) assessment; stock-assessment modelling.

Assessment: Modelling practicals with written test (25%); Tutorials with written assessment (75%, externally examined).

DP Requirement: Attendance at all tutorials.

Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components.

Marine Ecosystem Analysis

BIOL784 WC   (0L-30T-0P-0S-130H-0R-0F-0G-0A-7W-16C)

Prerequisite Requirement: 64C at Level 3 in biological sciences, of which 32C or equivalent must be in Aquatic/Marine topics.

Aim: To understand marine ecosystem functioning through theory discussions and data analyses.

Content: Marine ecosystem structure and functioning, resilience and organization; food-web analysis; species trophic interdependencies; indirect interspecies effects; species competition and mutualism; nutrient cycling; energy flow; ecosystem indices. Computer based exercises with respect to network analysis and ecosystem modelling.

Assessment: Continuous (100%); exercises comprising at least 50% of final mark externally examined.

DP Requirement: Not applicable.

Module taught in the semester prescribed in the honours handbook. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam.

Biology/Ecology Research Project

BIOL790 PY WY   (0L-10T-0P-10S-460H-0R-0F-0G-0A-26W-48C)

Corequisite: BIOL701.

Aim: To gain experience in formulation, planning, execution, analysis and reporting of a research project, and mastery of relevant techniques.

Content: Supervised research project requiring the student to collect, analyse and evaluate data, integrate practical and theoretical skills, develop independent and critical thought, and communicate effectively in the form of written and oral reports. Students will be provided with a list of supervisors and possible research topics. The choice of the research project will be decided by discussion between the student and supervisor.

Assessment: 2 presentations: project proposal & research findings (10%), written project proposal (5%), research report (85%, externally examined).

DP Requirement: Not applicable.

Year-long module. Subminimum to pass: 50% in project write-up. This module has no supplementary exam.

Marine Biology/Ecology Research Project
BIOL791 WY   (0L-10T-0P-10S-460H-0R-0F-0G-0A-26W-48C)
Corequisite: BIOL701.
Aim: To gain experience in formulation, planning, execution, analysis and reporting of a research project, and mastery of relevant techniques.
Content: Supervised research project requiring the student to collect, analyse and evaluate data, integrate practical and theoretical skills, develop independent and critical thought, and communicate effectively in the form of written and oral reports. Students will be provided with a list of supervisors and possible research topics. The choice of the research project will be decided by discussion between the student and supervisor.
Assessment: Seminars (10%), written proposal (5%), project (85%, of which 15% is for skills, attitudes & initiative, 25% for the first draft & 60% for the final written report).
DP Requirement: 100% attendance at all seminars, tutorials, and all scheduled activities (which include meetings with supervisor).
Year-long module. This module has no supplementary exam.

Applied Cell Biology for Env Engineers
BIOL851 HC   (30L-0T-9P-3S-86H-20R-0F-0G-12A-7W-16C)
Aim: To acquaint students without a biological background with the basic concepts of general biology, biochemistry & microbiology relevant to environmental engineering.
Content: Biological macromolecules; heredity & molecular biology; prokaryotic & eukaryotic cells; phylogeny of bacteria; microbial ecology; metabolic pathways; bioenergetics; enzyme kinetics; enzyme inhibition & regulation; microbial growth and Monod kinetics; overview of biological processes applied to waste treatment.
Practicals: Use of light microscope; identification of micro-organisms; aseptic laboratory technique; kinetic constants for a simple enzyme-catalysed reaction.
Assessment: Class test (10%), tutorials (10%), practical reports (15%), self-study assignment (15%); 3 h open-book exam (50%).
DP Requirement: Class mark of 40%.
Offered to Engineering students only.

Coastal Ecology
BIOL884 WC   (6L-18T-0P-16S-115H-2R-0F-0G-3A-7W-16C)
Prerequisite Requirement: 48C at Level 3 in relevant biological sciences, or permission of Dean.
Aim: To investigate in depth selected aspects relating to the nature of the South African coastal environment, plant and animal adaptations, ecosystem function and coastal management.
Content: Theoretical and practical study of the biologically relevant components of South Africa's coastal environment, including physiological and behavioural adaptations of the coastal flora and fauna, ecosystem function and coastal management.
Assessment: Review (50%), Field data report (30%), Oral presentation (15%), test (5%).
DP Requirement: Not applicable.
Offered in either Semester 1 or 2. Subminimum to pass: 50% weighted average in externally examined components. This module has no supplementary exam.

Biometry

Offered in the School of Mathematics, Statistics and Computer Science

Multiple Regression Analysis
BMET314 P1   (20L-0T-15P-0S-31H-10R-0F-0G-4A-13W-8C)
Prerequisite Modules: STAT130 or STAT230.
Aim: To provide an overview of multivariate regression methods, including logistic regression.
Content: Review of matrix algebra. Multiple linear regression methods, including least squares estimates, the variancecovariance matrix associated with such estimates and the concept of studentized residuals. Various forms of residual analytic methods. Data transformation including the Box-Cox method. Automatic model selection methods including forward, backward, stepwise and all-subsets selection. Logistic regression methods and the concept of odds-ratios.
Practicals: Computer-based exercises.
Assessment: Two tests (20%), practical assignments (10%); 2 h exam (70%).
DP Requirement: 30% Class mark; Minimum 80% of Practical attendance, completion of assignments & tutorials.

Multivariate Analysis
BMET316 P1   (20L-0T-21P-0S-25H-9R-0F-0G-5A-13W-8C)
Prerequisite Modules: STAT130 or STAT230.
Aim: To train students to use multivariate analysis.
Content: General principles of multivariate analysis. Principal component analysis, Factor analysis, Canonical correlation analysis, Cluster analysis, Discriminant analysis, MANOVA and other techniques. GENSTAT multivariate analysis.
Practicals: Computer-based exercises on the above topics.
Assessment: Two tests (20%), practical assignments (10%); 2 h exam (70%).
DP Requirement: 30% Class mark; Minimum 80% of practical attendance, completion of assignments & tutorials.

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Chemistry

Offered in the School of Chemistry and Physics

Special Science
CHEM100 H1   (38L-15T-0P-0S-71H-30R-0F-0G-6A-13W-16C)
Aim: To introduce nursing students to basic chemistry and physics relevant to their discipline.
Content: Chemistry: Units of measurement, properties of matter, radioactivity, chemical bonding and chemical reactions, the gaseous state, solutions, suspensions, colloids and emulsions, acids, bases and salts, organic chemistry, carbohydrates, lipids and proteins. Physics: Mechanics, statics, torque, equilibrium, work, energy, power, elastic and thermal properties of matter, mechanics of fluids, pressure, density, viscosity, cohesion, waves, sound light, nerve conduction, ionizing radiation, ultrasound, x-ray and radionuclide imaging.
Assessment: Tests, quizzes or assignments (33%); 3 h exam (67%).
DP Requirement: Class mark 40%, 100% attendance at tests.
For students in the School of Nursing only.

General Principles of Chemistry
CHEM110 P1 W1   (36L-9T-36P-0S-44H-30R-0F-0G-5A-13W-16C)
Aim: To introduce the principles and practice of chemistry.
Content: Introduction to: quantitative chemistry, types of reaction, atomic spectroscopy, electronic configuration, bonding, gases, chemistry of main group elements.
Practicals: Volumetric analysis, shapes of molecules, qualitative analysis.

Assessment: Tests (9%), quizzes (5%), practical reports (19%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
Credit may not be obtained for both CHEM110 and either of CHEM161 or CHEM195.

Chemical Reactivity
CHEM120 P2 W2   (36L-9T-36P-0S-44H-30R-0F-0G-5A-13W-16C)
Prerequisite Requirement: At least 40% in CHEM110.
Aim: To present the physical and descriptive inorganic and organic aspects of introductory chemistry.
Content: Phase equilibria and colligative properties, buffers, electrochemistry, nomenclature, thermochemistry, kinetics, and gas and solution equilibria. Introduction to organic chemistry, formation of different organic functionalities and reactions thereof, stereochemistry, reaction mechanisms.
Practicals: Physical measurements, organic techniques.
Assessment: Tests (9%), quizzes (5%), practical reports (19%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
Credit may not be obtained for both CHEM120 and either of CHEM171 or CHEM196.

Chemical Engineering Chemistry 1
CHEM161 H1   (36L-9T-36P-0S-44H-30R-0F-0G-5A-13W-16C)
Aim: To introduce the principles and practice of chemistry.
Content: Introduction to: quantitative chemistry, types of reaction, atomic spectroscopy, electronic configuration, chemical bonding, gases, and chemistry of the main group elements.
Practicals: Volumetric analysis, shapes of molecules, qualitative analysis.
Assessment: Tests (9%), quizzes (5%), practical reports (19%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
For Engineering students only. Credit may not be obtained for both CHEM161 and either of CHEM110 or CHEM195.

Chemistry & Society 1
CHEM163 P1   (18L-9T-18P-0S-26H-6R-0F-0G-3A-13W-8C)
Aim: To provide students with an overview of the role chemistry plays in everyday life.
Content: Revision of the mole; energy in chemical reactions; kinetics; equilibrium; gas laws; solubility; acids and bases; redox chemistry; electrochemical processes.
Practicals: Measurement of physical constants.
Assessment: Tests (7%), practical reports (26%); 2 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests. **For Engineering students only.**

Chemical Engineering Chemistry 2
CHEM171 H2   (36L-9T-36P-0S-44H-30R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 40% in CHEM161.
Aim: To present the physical and organic aspects of introductory chemistry.
Content: Thermochemistry and thermodynamics, chemical kinetics, chemical equilibrium, acid/base equilibria, phase equilibria and colligative properties, buffers, electrochemistry, organic chemistry including nomenclature, alkanes, alkenes and alkynes, stereochemistry, alcohols, ethers and haloalkynes, S_N1 and S_N2 reactions, carboxylic acids, amines and amides, basic reaction mechanisms.
Practicals: Physical measurements and organic techniques.
Assessment: Tests (9%), quizzes (5%), practical reports (19%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
For Engineering students only. Credit may not be obtained for both CHEM171 and either of CHEM120 or CHEM196.

Chemistry & Society 2

CHEM173 P2   (18L-9T-18P-0S-24H-8R-0F-0G-3A-13W-8C)

Aim: To provide students with an overview of the role chemistry plays in everyday life.
Content: The Periodic Table - elements, trends and classification; bonding - covalent, ionic and metallic; chemical and physical properties arising from bonding - some specific examples; polymers - PVC, Teflon, Nylon-6,6, silicones, polyethylene, additives, physical properties; explosives.
Practicals: Qualitative analysis.
Assessment: Tests (7%), practical reports (26%); 2 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
For Engineering students only.

Chemistry for Engineers 1A

CHEM181 H1   (18L-5T-18P-0S-24H-12R-0F-0G-3A-13W-8C)

Aim: To provide students with the basic chemical knowledge and expertise necessary to understand the chemical behaviour and properties of materials used by engineers.
Content: Units, measurements; elements; compounds and reactions; mole; bonding in compounds. Cements, silicates and silicones. Stoichiometry; gases and gas laws, Henry's Law. Thermochemistry.
Practicals: Introduction to the measurement of chemical properties; study of chemical behaviour of simple substances.
Assessment: Tests (8%), Practicals (25%); 2 h Exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
For Engineering students only.

Chemistry for Engineers 1B

CHEM191 H2   (18L-5T-18P-0S-24H-12R-0F-0G-3A-13W-8C)

Prerequisite Requirement: 40% in CHEM181.
Aim: To provide students, who would now have some basic chemical background, with further information and skills needed to understand how substances behave chemically.
Content: Water - its chemistry and purification. Rates of reaction. Equilibrium. Acids, bases, buffers, pH. Solubility. Oxidation/reduction, electrochemistry, conductivity, corrosion, batteries. Chemistry of selected metals and their compounds. Chemistry of carbon and its compounds. Phase changes, phase diagrams.
Practicals: The practical study of inorganic and organic materials.
Assessment: Tests (8%), Practicals (25%); 2 h Exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
For Engineering students only.

General Principles of Chemistry (Augmented)

CHEM195 PY WY   (72L-18T-66P-0S-90H-60R-0F-0G-14A-26W-16FC-16DC)

Aim: To introduce the principles and practice of chemistry.
Content: This module is available only to students registered for the augmented stream of the BSc4. It covers the syllabus of CHEM110 but, in addition, includes a substantial amount of supplementary material and tuition designed for students who are under-prepared for university-level studies to a maximum of 160 hours.
Practicals: Volumetric analysis, shapes of molecules, qualitative analysis.
Assessment: Tests/Assignments (30%), practical reports (20%); 3 hr theory exam (50%).
DP Requirement: Class mark 40%, Attendance at 80% of lectures, practicals and tutorials and 100% attendance at all assessments.
Credit may not be obtained for both CHEM195 and either of CHEM110 or CHEM161. This module is worth 16 degree credits and 16 foundation credits.

Chemical Reactivity (Augmented)

CHEM196 PY WY   (72L-18T-66P-0S-90H-60R-0F-0G-14A-26W-16FC-16DC)

Prerequisite Requirement: At least 40% in CHEM110 or CHEM195.
Aim: To present the physical and descriptive inorganic and organic aspects of introductory chemistry.
Content: This module is available only to students registered for the Augmented stream of the BSc4. It covers the syllabus of CHEM120 but, in addition, includes a substantial amount of supplementary material and tuition designed for students who are under-prepared for university-level studies to a maximum of 160 hours.
Practicals: Physical measurements, organic techniques
Assessment: Tests/Assignments (30%), practical reports (20%); 3 h exam (50%).
DP Requirement: Class mark 40%, Attendance at 80% of lectures, practicals and tutorials and 100% attendance at all assessments.
Credit may not be obtained for both CHEM196 and either of CHEM120 or CHEM171. This module is worth 16 degree credits and 16 foundation credits.

Inorganic Chemistry
CHEM210 P1 W1   (27L-9T-36P-0S-44H-39R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 55% in CHEM120.
Prerequisite Modules: CHEM110.
Aim: To develop a theoretical and content base for inorganic chemistry.
Content: Molecular orbital theory of diatomic molecules, coordination chemistry: ligands and complexes, introduction to solid state chemistry, descriptive main group element chemistry.
Practicals: Synthesis and characterization of main group and coordination compounds.
Assessment: Tests (15%), practical reports (18%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.

Organic Chemistry
CHEM220 P1 W1   (27L-9T-36P-0S-43H-40R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 55% in CHEM120.
Prerequisite Modules: CHEM110.
Aim: To introduce students to carbonyl, aromatic and aliphatic chemistry and basic spectroscopic methods used in the identification of organic compounds.
Content: An introduction to nuclear magnetic resonance spectroscopy, stereochemistry, carbonyl chemistry, the chemistry of aromatic compounds and alkenes, substitution and elimination reactions.
Practicals: The preparation and characterization of organic compounds.
Assessment: Tests (15%), practicals (18%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.

Physical Chemistry
CHEM230 P2 W2   (27L-9T-36P-0S-66H-17R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 55% in CHEM120; at least 24C of appropriate MATH at Level 1.
Prerequisite Modules: CHEM110.
Aim: To introduce students to the principles of the discipline of physical chemistry, and to develop an appreciation of its quantitative aspects and the way in which it underpins the whole of modern chemistry.
Content: Chemical thermodynamics, chemical equilibrium, equilibrium electrochemistry, kinetics, introduction to spectroscopy.
Practicals: Measurement and calculation of thermodynamic, kinetic and spectroscopic data.
Assessment: Tests (8%), practical reports (25%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.

Applied Organic Chemistry for Chem Eng
CHEM241 H1   (14L-0T-18P-0S-25H-20R-0F-0G-3A-13W-8C)
Prerequisite Modules: CHEM161 and CHEM171.

Aim: To provide students with a basic understanding and relevant skills in selected areas of organic chemistry relevant to chemical engineers.
Content: The reaction of aliphatic and aromatic functional groups. Polymers. Petrochemical. Sugars. Proteins and Pharmaceutical chemistry. Spectroscopic methods.
Practicals: Six 3 h practicals relating to the course content.
Assessment: Tests (15%), practicals (18%); 2 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
For Engineering students only.

Applied Physical Chemistry for Chem Eng
CHEM251 H2   (14L-0T-18P-0S-25H-20R-0F-0G-3A-13W-8C)
Prerequisite Modules: CHEM161 and CHEM171.
Aim: To provide students with a basic understanding and relevant skills in selected areas of physical chemistry.
Content: Properties of gases, chemical thermodynamics, chemical equilibrium, equilibrium electrochemistry.
Practicals: Measurement of physical quantities.
Assessment: Tests (8%), practicals (25%); 2 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
For Engineering students only.

Applied Inorganic Chemistry for Chem Eng
CHEM261 H1   (14L-0T-18P-0S-25H-20R-0F-0G-3A-13W-8C)
Prerequisite Modules: CHEM161 and CHEM171.
Aim: To provide students with a basic understanding and relevant skills in selected areas of inorganic chemistry.
Content: Co-ordination compounds, solvent extraction, kinetics of substitution. Ionic solids, slags and mattes. Descriptive chemistry of 3-d metals, platinum metals, uranium. Hydrometallurgy and pyrometallurgy: extraction processes for copper, nickel cobalt, gold, platinum metals, uranium.
Practicals: Preparation and reactions of co-ordination complexes.
Assessment: Tests (11%), practicals (22%); 2 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.
For Engineering students only.

Inorganic Chemistry
CHEM310 P2 W2   (27L-9T-36P-0S-44H-39R-0F-0G-5A-13W-16C)
Prerequisite Modules: CHEM210.
Aim: To build a strong theoretical and content base in inorganic chemistry, appropriate for an exit level module.
Content: Crystal field theory and molecular orbital theory of transition metal complexes. Transition metal chemistry: variable oxidation states and solution chemistry. Sigma-donor and pi-acceptor ligands, focusing on coordinated CO and its reactivity. Magnetic and electrical properties of transition metal oxides.
Practicals: Synthesis of transition metal and organometallic compounds: characterization and qualitative analysis.
Assessment: Tests (10%), practical reports (25%); 3 h exam (65%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.

Organic Chemistry
CHEM320 P2 W2   (27L-9T-36P-0S-43H-40R-0F-0G-5A-13W-16C)
Prerequisite Modules: CHEM220.
Aim: To introduce students to the structure and synthesis of carbocyclic and heterocyclic compounds as well as to more advanced applications of carbonyl chemistry and spectroscopic analysis.
Content: Heterocyclic and carbocyclic chemistry. Selected topics from: conformational analysis, biological organic molecules and spectroscopy.
Practicals: The preparation and characterisation of organic compounds.
Assessment: Tests (15%), practicals (18%); 3 h exam (67%).

DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.

Physical Chemistry
CHEM330 P1 W1   (27L-9T-36P-0S-66H-17R-0F-0G-5A-13W-16C)
Prerequisite Requirement: At least 24C PHYS at Level 1.
Prerequisite Modules: CHEM230.
Aim: To deepen knowledge and understanding of the underlying principles of physical chemistry and to develop skills in their application.
Content: Advanced aspects of chemical thermodynamics and kinetics. Surface chemistry. Quantum Chemistry. Molecular spectroscopy.
Practicals: Measurement of physicochemical properties; recording, calculation, manipulation and interpretation of data; proper methodology in scientific report writing.
Assessment: Tests (8%), practical reports (25%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.

Instrumental Analysis
CHEM340 P1 W1   (27L-9T-36P-0S-66H-17R-0F-0G-5A-13W-16C)
Prerequisite Requirement: At least 24C PHYS at Level 1.
Prerequisite Modules: CHEM230.
Aim: To introduce students to instrumental methods of analysis.
Content: Atomic spectroscopy; chromatography; spectroscopic analysis; electroanalytical methods; solid-state analysis.
Practicals: Instrumental methods of qualitative and quantitative analysis.
Assessment: Tests (8%), practicals (25%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.

Inorganic and Physical Chemistry
CHEM733 P1   (40L-10T-0P-0S-89H-16R-0F-0G-5A-13W-16C)
Aim: To introduce students to advanced studies in Inorganic and Physical Chemistry.
Content: Mechanisms and rates of inorganic reactions, organometallic chemistry and homogeneous catalysis, advanced chemical thermodynamics, surface chemistry and dynamic electrochemistry.
Assessment: Tests and/or assignments (40%); 3 h exam (60%).
DP Requirement: Class mark 40%.

Organic and Analytical Chemistry
CHEM743 P1   (40L-10T-0P-0S-89H-16R-0F-0G-5A-13W-16C)
Aim: To show how the principles of chemistry can be used in advanced applications of Organic and Analytical Chemistry.
Content: Use of advanced NMR, mass spectroscopy and other spectroscopic techniques for structural elucidation. Pericyclic reactions. Stereocontrol in organic synthesis. Advanced synthetic organic chemistry. Advanced instrumental analysis.
Assessment: Tests and/or assignments (40%); 3 h exam (60%).
DP Requirement: Class mark 40%.

Research Methodology
CHEM751 W1   (36L-20T-0P-0S-83H-0R-0F-18G-3A-13W-16C)
Corequisite: CHEM761.
Aim: To introduce fundamental and advanced research skills and methods within chemistry.

Content: Research methods; communication and presentation of research results; Theory and practice of advanced spectroscopies and characterization methods for molecular compounds and materials; analyses methods, synthesis methods; lab assignments.
Assessment: Assignments (problem solving, presentation, report, tests) of equal weight (50%). Written proposal (50%). **DP Requirement:** Not applicable.

Group Theory & Spectroscopy
CHEM753 P1   (18L-2T-0P-0S-48H-8R-0F-0G-4A-13W-8C)
Aim: To provide students with a thorough but understandable introduction to molecular symmetry and group theory as applied to the spectroscopy of inorganic complexes.
Content: Identification of symmetry elements, point group identification, use of point group multiplication tables, application of group theory to spectroscopy, electronic states of atoms and molecules - term symbols, advanced crystal field theory.
Assessment: Tests and/or assignments (40%); 3 h exam (60%).
DP Requirement: Class mark 40%.

Advanced Chemistry
CHEM761 W1   (92L-0T-0P-0S-280H-92R-0F-0G-16A-13W-48C)
Corequisite: CHEM751.
Aim: To introduce students to advanced study in analytical, inorganic, organic and physical chemistry.
Content: *Analytical*: Sampling; advanced analytical and hyphenated techniques. *Inorganic*: Inorganic and organometallic chemistry. Catalysis. Ligand design. Materials chemistry. Characterisation techniques. Applications. *Organic*: Organic synthetic reactions and their mechanisms. Chirality and stereochemistry. *Physical*: Group theory, selected advanced topics in thermodynamics and kinetics, and applications thereof.
Assessment: Tests, assignments and/or presentations (20%); 3 h exam (80%) for each of the four sections. A 40% subminimum for each section is required.
DP Requirement: Class mark 50%. Class attendance 80%.

Special Topics in Chemistry
CHEM763 P2   (105L-18T-0P-0S-120H-67R-0F-0G-10A-13W-32C)
Aim: To allow students to specialize in their chosen areas of advanced chemistry.
Content: Topics selected from (amongst others) - bioinorganic chemistry; strategies in drug synthesis and design; symmetry in the solid state; natural products, isolation and characterisation; isolation and properties of the lanthanides and actinides; thermodynamics of reaction equilibria in solution; kinetic theory and its application to inorganic complexes.
Assessment: Tests and/or assignments (40%); 4 x 2 h exams (60%).
DP Requirement: Class mark 40%.

Computational Chemistry
CHEM773 P1   (10L-20T-0P-0S-39H-8R-0F-0G-3A-13W-8C)
Aim: To introduce the theory and practice of modern computational chemistry techniques and their application in solving problems in organic, inorganic and physical chemistry.
Content: Construction of in silico structures for input as simulation starting points, geometry optimization by molecular mechanics simulations, force field parameterization, basic principles of quantum mechanical molecular models including wave functions, operators and Eigenvalues, approximations, open- and closed-shell systems, *ab initio* and semiempirical simulation methods including basis sets and their development and density functional theory models.
Assessment: Tests and/or assignments (50%); 3 h exam (50%).
DP Requirement: Class mark 40%.

Chemistry Electives
CHEM781 W2   (60L-0T-0P-0S-202H-52R-0F-0G-6A-13W-32C)

Prerequisite Modules: CHEM761.
Aim: To enable students to specialise in various areas of Chemistry.
Content: Students select from a range of topics. Examples of topics offered are: waste disposal, environmental analysis, bioinorganic chemistry, catalysis, supramolecular chemistry, medicinal chemistry, solid phase peptide synthesis, synthesis and biosynthesis of natural products, molecular spectroscopy, statistical thermodynamics, photochemistry of nucleic acid bases and solution chemistry.
Assessment: Assignments (20%); 2 × 3 h exams (80%).
DP Requirement: Class mark 40%.

Chemistry Project I
CHEM791 W2   (0L-0T-0P-0S-320H-0R-0F-0G-0A-13W-32C)
Prerequisite Modules: CHEM751.
Aim: To introduce students to the process of scientific research.
Content: Students will undertake a research project selected from a list proposed by members of staff. Topics will change from year to year.
Assessment: Project execution (10%), written report (70%), oral presentation (20%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Chemistry Project
CHEM793 PY   (0L-0T-320P-8S-132H-0R-0F-20G-0A-26W-48C)
Aim: To introduce students to the process of scientific research in Chemistry and communication of scientific information.
Content: Workshops on software for chemists, generic skills, structure elucidation techniques, advanced quantitative analysis, literature review essay, preparation of research proposal, laboratory work, preparation of project report, seminar presentations.
Practicals: Use of advanced instrumental techniques for structure elucidation and quantitative analysis.
Assessment: Workshop assignments (10%), literature review essay (10%), research proposal (5%), laboratory performance (10%), seminar presentations (15%), project report assessment (50%).
DP Requirement: Not applicable.
Year-long module. This module has no supplementary exam.

Computer Science

Introduction to Computer Science
COMP100 P1 W1   (39L-0T-36P-0S-63H-16R-0F-0G-6A-13W-16C)
Prerequisite Requirement: Either Matric Maths HGD or SGA or NSC Maths at Level 5.
Aim: To introduce students to the basics of computer science.
Content: Overview of computer science. Basic computer literacy. Problem solving and algorithm design. Simple machine architecture. Simple programming in a high level programming language. Program debugging and testing.
Assessment: Class mark 50% (at least 2 theory tests (25%), at least 1 practical test (20%), practicals/assignments /quizzes/tests (5%)); 3 h exam (50%), with a sub-minimum of 40% on the exam.
DP Requirement: Class mark 40%, attendance at 80% of the practicals.
Credit may not be obtained for both COMP100 and any of COMP106, ISTN100, ISTN101, ISTN 103 and LIIS 120.

Computer Programming
COMP102 P2 W2   (39L-0T-36P-0S-63H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: COMP100.
Aim: To introduce students to programming in a high level language.

Content: Procedural programming in a high level programming language. Structured data types. Sorting. Searching. Recursion. Program testing. Program documentation. Introduction to object-oriented programming.
Assessment: Class mark 50% (at least 2 theory tests (25%), at least 1 practical test (20%), practicals/assignments /quizzes/tests (5%)); 3 h exam (50%), with a sub-minimum of 40% on the exam.
DP Requirement: Class mark 40%, attendance at 80% of the practicals.

Computing for Natural Scientists
COMP106 P2 W2   (39L-0T-36P-0S-61H-16R-0F-0G-8A-13W-16C)
Prerequisite Requirement: 40% in MATH130, 150, 151, 195 or STAT130.
Aim: To enable Life Science students to make effective use of computers in communicating, researching information, managing and analysing data, and presenting their findings as reports or presentations.
Content: Introduction to computer systems: Information systems. Computer basics, system software, malware and exploits. Productivity software: Word processing, spreadsheets, and presentation software. Research tools: Web based tools, working with the web. Introduction to LaTeX. Advanced computing tools: Introduction to databases, mathematical modelling with spreadsheets.
Assessment: Class mark 50% (Theory tests (20%), practical tests (20%); practical assignments (10%)), 3h exam (50%), with a sub-minimum of 40% on the exam.
DP Requirement: 40% class mark, attendance at 80% of the practicals.
Credit may not be obtained for both COMP106 and COMP100.

Foundations of Computer Science
COMP107 P2 W2   (39L-39T-0P-0S-60H-16R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 40% in MATH130 or MATH195.
Aim: To develop an integrated understanding of the theoretical and mathematical foundations of Computer Science and to develop problem solving skills including but not limited to creating and manipulating abstractions, facility with the use of formal languages, and reasoning and argumentation.
Content Computational Logic: Sets, Relations and Functions, Propositional and Predicate Logic. Circuit Theory. Finite State Machines and Regular Expressions.
Assessment: 3 tests (30%); 3h exam (70%).
DP Requirement: 40% class mark, attendance at 80% of the practicals.

Object-Oriented Programming
COMP200 P1 W1   (29L-0T-36P-0S-73H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: COMP102; MATH130 or 195.
Aim: To introduce students to the fundamentals of object-oriented programming.
Content: Object-oriented programming with Java: classes, inheritance and polymorphism. Object-oriented design methodology and notation. Introduction to abstract data types. Container classes and iterators. Advanced programming constructs. Object-oriented GUI.
Assessment: Class mark 50% (at least 2 theory tests (25%), at least 1 practical test (20%), at least 1 assignment/quiz (5%)), 3 h exam (50%), with a sub-minimum of 40% on the exam.
DP Requirement: At least 40% for continuous assessment, attendance at 80% of the practicals.

Data Structures
COMP201 P2 W2   (29L-0T-36P-0S-73H-16R-0F-0G-6A-13W-16C)
Prerequisite Requirement: At least 40% in COMP200.
Prerequisite Modules: MATH140 or 196.
Aim: To introduce students to the fundamentals of data structures.
Content: Data abstraction and encapsulation. Specification and implementation of data structures. Linear structures. Order and iterators. Trees, sets and dictionaries. Graphs. Canned data structures. Introduction to algorithms and complexity.

Assessment: Class mark 50% (at least 2 theory tests (25%), at least 1 practical test (20%), at least 1 assignment/quiz (5%)), 3 h exam (50%), with a sub-minimum of 40% on the exam.
DP Requirement: Class mark 40%, attendance at 80% of the practicals.

Internet Technologies
COMP203 P2   (29L-0T-36P-0S-73H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: COMP102; MATH130 or 195.
Aim: To introduce students to the fundamentals associated with the development of web-based client server systems.
Content: Scripting as a programming paradigm. Models for the implementation and interaction of clients and servers. Security and performance issues in distributed systems. Persistence of user generated data.
Assessment: Class mark (A minimum of 2 tests, both theoretical and practical (30%), assessment of project work (15%), assignments/quizzes (5%)), 3 h exam (50%) with a sub-minimum of 40% on the exam.
DP Requirement: Class mark 40%, attendance at 80% of the practicals.

Computer Organisation and Architecture
COMP204 W2   (29L-0T-36P-0S-73H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: COMP102; MATH130 or 195.
Aim: To develop an understanding of computer architecture and assembly language programming.
Content: Digital logic and machine level data representation. Computer architecture and organization. Input/output fundamentals: handshaking and buffering; interrupt mechanisms; buses. Memory architecture. Multiprocessing. Assembly language programming.
Assessment: Class mark (30%) (at least 2 theoretical or practical tests (20%), practicals / assignments / quizzes (10%)), 3 h exam (70%), with a sub-minimum of 40% on the exam.
DP Requirement: 40% class mark, attendance at 80% of the practicals.

Comparative Programming Languages
COMP300 W2   (29L-0T-36P-0S-73H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: COMP200 and COMP201.
Aim: To introduce students to various programming language paradigms.
Content: Historical survey. Imperative languages. Types, objects and declarations, expressions and statements, subprograms, data structures, modules. Object-oriented programming. Generic programming. Functional languages. Declarative languages. Logic programming. SQL. Syntax and semantics. Current trends.
Assessment: Class mark 30% (2 tests (20%), practicals/assignments/quizzes (10%)), 3 h exam (70%), with a subminimum of 40% on the exam.
DP Requirement: Class mark 40%, attendance at 80% of the practicals.

Software Design
COMP301 W2   (29L-0T-36P-0S-73H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: COMP200, 201.
Aim: To introduce students to the principles of software design.
Content: Software design concepts and models. Object-oriented design using UML. Architectural and/or design patterns. User-interface design. Software testing. Software deployment. Major design and programming project.
Assessment: Class mark 50% (at least 2 tests (25%), project (25%)), 3 h exam (50%), with a sub-minimum of 40% on the exam.
DP Requirement: Class mark 40%, attendance at 80% of the practicals.

Artificial Intelligence
COMP304 P2 W2   (29L-0T-36P-0S-73H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: COMP200 and COMP201.
Aim: To introduce students to Artificial Intelligence concepts.

Content: Problem & knowledge representation. Logic, search & heuristics. Applications from game-playing. Expert systems. Neural networks. Genetic algorithms. Automatic theorem proving.

Assessment: Class mark 30% (2 tests (20%), practicals/assignments/quizzes (10%)), 3 h exam (70%), with a subminimum of 40% on the exam.

DP Requirement: Class mark 40%, attendance at 80% of the practicals.

Database Systems

COMP306 W1 (29L-0T-36P-0S-73H-16R-0F-0G-6A-13W-16C)

Prerequisite Modules: COMP200 and COMP201.

Aim: To make students familiar with Database concepts.

Content: Database models. Relational & object-oriented systems. Database programming languages: SQL, QBE & JDBC. Database architectures. Client-server, distributed & parallel, applications.

Assessment: Class mark 30% (2 tests (20%), practicals/assignments/quizzes (10%)), 3 h exam (70%), with a subminimum of 40% on the exam.

DP Requirement: Class mark 40%, attendance at 80% of the practicals.

Graphics & Modelling

COMP307 W2 (29L-0T-36P-0S-73H-16R-0F-0G-6A-13W-16C)

Prerequisite Modules: COMP200 and COMP201.

Aim: To introduce students to a modern 3D-modelling language.

Content: 3D-modelling concepts. A modern 3D-modelling language. Scripting. Animation techniques.

Assessment: Class mark (30%) (2 tests (20%), practicals/assignments/quizzes (10%)), 3 h exam (70%) with a subminimum of 40% on the exam.

DP Requirement: Class mark 40%, attendance at 80% of the practicals.

Computer Systems

COMP313 P1 W1 (29L-0T-36P-0S-73H-16R-0F-0G-6A-13W-16C)

Prerequisite Modules: COMP200, 201.

Aim: To introduce Operating Systems and Data Communication concepts.

Content: The Unix Operating System. Operating Systems Concepts including process management, memory management, input/output, concurrency, deadlock and file systems. Data communications and Networking concepts. Net-centric programming. Computer security concepts.

Assessment: Class mark 30% (2 tests (20%), practicals assignments / quizzes (10%)), 3 h exam (70%), with a subminimum of 40% on the exam.

DP Requirement: 40% Class mark, attendance at 80% of the practicals.

Theory of Computation

COMP314 P2 W2 (29L-0T-36P-0S-73H-16R-0F-0G-6A-13W-16C)

Prerequisite Modules: COMP200, 201, 16C of Level-2 MATH.

Aim: To introduce students to formal languages, computability and complexity.

Content: Formal languages: regular and non-regular languages, context-free languages. Computability and complexity theory: Includes (but is not limited to) Turing machines, the Universal Turing machine, Church-Turing thesis, decidability, complexity classes P and NP.

Assessment: Class mark 30% (2 tests (20%), practicals/assignments/quizzes (10%)); 3 h exam (70%), with a subminimum of 40% on the exam.

DP Requirement: 40% class mark, attendance at 80% of the practicals.

Advanced Programming

COMP315 P1 W1 (29L-0T-36P-0S-73H-16R-0F-0G-6A-13W-16C)

Prerequisite Modules: COMP200, 201.

Aim: To introduce advanced programming techniques necessary for the development of large, complex software.
Content: Advanced programming concepts and techniques. Advanced object-oriented programming. User interface design. Software engineering practice. Major programming project.
Assessment: Class mark 50% (At least 2 tests (25%), practical assignments/programming project (25%)) 3 h exam (50%) with a sub-minimum of 40% on the exam.
DP Requirement: 40% class mark, attendance at 80% of the practicals and satisfactory completion of programming project.

Natural Language Processing
COMP316 W1   (29L-0T-36P-0S-73H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: COMP200, 201.
Aim: To introduce students to the fundamentals of natural language processing.
Content: Introduction to natural language processing, Phonetics, Morphology, Part-of-Speech Tagging, Syntactic Analysis, Semantic Analysis, Pragmatics, Generation, Applications.
Assessment: Practicals/assignments/quizzes (10%), tests (20%); 3 h exam (70%).
DP Requirement: 40% class mark, attendance at 80% of the practicals.

Honours Project
COMP700 PY WY   (0L-0T-0P-0S-320H-0R-0F-0G-0A-26W-32C)
Aim: To get students to tackle a large programming project.
Content: Project topics from computer science.
Assessment: Proposal (5%), Design (10%), Oral presentation (10%), Mini-thesis & demo (75%).
DP Requirement: Not applicable.
Year Long Module. This module has no supplementary exam.

Image Processing and Computer Vision
COMP702 WC   (19L-0T-13P-0S-106H-16R-0F-0G-6A-13W-16C)
Aim: To introduce students to image processing and computer vision.
Content: Digital image fundamentals. Data structures for image processing. Pre-processing and image amelioration. Mathematical morphology. Feature extraction. Segmentation. Transformation. Compression. Pattern recognition. Motion analysis.
Assessment: Continuous assessment (100%): At least 2 formal Tests (Practical / programming and/or theory based tests) (50 %): Assignments (both written and practical) and project work (individual or groupwork) (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary exam.

Artificial Intelligence
COMP703 PC WC   (19L-0T-13P-0S-106H-16R-0F-0G-6A-13W-16C)
Aim: To give students an in-depth coverage of artificial intelligence.
Content: In-depth coverage of one or more areas of artificial intelligence such as expert systems, game-playing, genetic algorithms, automated theorem proving, natural language processing.
Assessment: Continuous assessment (100%): At least 2 formal Tests (Practical / programming and/or theory based tests) (50 %): Assignments (both written and practical) and project work (individual or groupwork) (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary exam.

Cryptography & Network Security
COMP707 PC WC   (19L-0T-13P-0S-106H-16R-0F-0G-6A-13W-16C)
Aim: To introduce students to cryptography & network security.
Content: Topics from modern cryptography, including symmetric & public-key cryptosystems, digital signature schemes, information theory, principles of network security.

Assessment: Continuous assessment (100%): At least 2 formal Tests (Practical / programming and/or theory based tests) (50 %): Assignments (both written and practical) and project work (individual or groupwork) (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary exam.

Language Translation Systems
COMP709 PC   (19L-0T-13P-0S-106H-16R-0F-0G-6A-13W-16C)
Aim: To introduce students to language translation systems.
Content: Syntax and semantics of languages. Levels of programming languages. Elements of formal grammars. Lexical and syntactic analysis. Languages with rigid format and their translation. Translation, compilation and interpretation of high level programming languages.
Assessment: Continuous assessment (100%): At least 2 formal Tests (Practical / programming and/or theory based tests) (50 %): Assignments (both written and practical) and project work (individual or groupwork) (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary exam.

Bioinformatics
COMP710 PC   (19L-0T-13P-0S-106H-16R-0F-0G-6A-13W-16C)
Aim: To introduce students to bioinformatics.
Content: Basic genetic processes. Review of mathematical, computational and statistical background. Comparison of sequences. Multiple sequences alignment. Fragment reassembly. Protein structure prediction. Statistical processes in genetics. Project related to student background. Special topics.
Assessment: Continuous assessment (100%): At least 2 formal Tests (Practical / programming and/or theory based tests) (50 %): Assignments (both written and practical) and project work (individual or groupwork) (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary exam.

Medical Informatics
COMP711 PC WC   (19L-0T-13P-0S-106H-16R-0F-0G-6A-13W-16C)
Aim: To introduce students to medical informatics.
Content: Selected topics from Medical Informatics, Medical coding, image archiving, patient records, hospital networks.
Assessment: Continuous assessment (100%): At least 2 formal Tests (Practical / programming and/or theory based tests) (50 %): Assignments (both written and practical) and project work (individual or groupwork) (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary exam.

Computer Graphics
COMP712 PC WC   (19L-0T-13P-0S-106H-16R-0F-0G-6A-13W-16C)
Aim: To introduce students to computer graphics.
Content: Graphic systems, fundamental techniques in graphics: including primitives, modelling, rendering, texture mapping, lighting, reflections, shadows, animation. Topics from illumination models, viewing pipeline, homogenous coordinate systems, 3D clipping, shading models, transformations, hidden surface removal, visualization, virtual reality, codecs. The practical aspect is covered using OpenGL.
Assessment: Continuous assessment (100%): At least 2 formal Tests (Practical / programming and/or theory based tests) (50 %): Assignments (both written and practical) and project work (individual or groupwork) (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary exam.

Contemporary Topics in Computer Science A
COMP717 PC WC   (19L-0T-13P-0S-106H-16R-0F-0G-6A-13W-16C)
Aim: To give students access to a current hot topic in Computer Science.
Content: Topics in computer science, dependent on staff expertise and availability.
Assessment: Continuous assessment (100%): At least 2 formal Tests (Practical / programming and/or theory based tests) (50 %): Assignments (both written and practical) and project work (individual or groupwork) (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary exam.

Contemporary Topics in Computer Science B
COMP718 PC WC   (19L-0T-13P-0S-106H-16R-0F-0G-6A-13W-16C)
Aim: To give students access to a current hot topic in Computer Science.
Content: Topics in computer science, dependent on staff expertise and availability.
Assessment: Continuous assessment (100%): At least 2 formal Tests (Practical / programming and/or theory based tests) (50 %): Assignments (both written and practical) and project work (individual or groupwork) (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary exam.

Optimization and Modelling
COMP719 PC WC   (19L-0T-13P-0S-106H-16R-0F-0G-6A-13W-16C)
Prerequisite Requirement: BSc (Computer Science) with a weighted average of at least 55% over third year level core Computer Science modules.
Aim: To introduce students to optimization and modelling techniques to solve real-world optimization problems.
Content: An introduction to the different optimization problems and methods. Introduction to heuristics and metaheuristics. Application of metaheuristics to real-world optimization problems, examples in space allocation, scheduling and planning amongst others.
Assessment: Continuous assessment (100%): At least 2 formal tests (Practical/ programming and/or theory based tests) (50%): Assignments (both written and practical) and project work (individual or group work) (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary exam.

Ontologies and Knowledge Bases
COMP720 PC WC   (19L-0T-13P-0S-106H-16R-0F-0G-6A-13W-16C)
Prerequisite Requirement: BSc (Computer Science) with a weighted average of at least 55% over third year level core Computer Science modules.
Aim: To introduce students to ontologies and knowledge bases.
Content: Logic foundations for ontologies, languages, and automated reasoning. Top-down and bottom-up ontology engineering. Methodologies for ontology development and maintenance, methods to enhance ontology quality and to automate some aspect of the methodology. Advanced topics and research trends such as temporal ontologies, ontologybased data access, ontology-driven conceptual data modelling, modularization.
Assessment: Continuous assessment (100%): at least 2 formal tests (Practical/ programming and/or theory based tests) (50%): Assignments (both written and practical) and project work (individual or group work) (50%).
DP Requirement: Not applicable
Offered in either Semester 1 or Semester 2.
This module has no supplementary exam.

Machine Learning
COMP721 PC WC   (39L-0T-13P-36S-59H-13R-0F-0G-36A-15W-16C)
Prerequisite Requirement: None.
Aim: To provide an in-depth introduction to the two main areas of Machine Learning: supervised and unsupervised, and to be able to formulate Machine Learning problems corresponding to different applications.

Content: It covers the two main areas of Machine Learning: supervised and unsupervised, and it introduces the models and algorithms for regression, classification, clustering and decision processes.
Assessment: Continuous assessment (100%): At least 2 formal Tests (Theory and /or Practical based tests).
DP Requirement: Not applicable
Offered in either Semester 1 or Semester 2.

This module has no supplementary exam.

Distributed Computing
COMP722 PC WC   (19L-0T-13P-0S-76H-16R-0F-0G-36A-15W-16C)
Prerequisite Requirement: None.
Aim: To introduce distributed software development concepts and provide practical exposure to relevant software and protocols that are needed to manage the complexity of integrating distributed systems.
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Content: Characterization of Distributed Systems, Data Oriented and Service Oriented Architectures and Protocols, Distributed Objects and Remote Invocation, Security and Infrastructure requirements, Cloud Computing concepts.
Assessment: Continuous assessment (100%): At least 2 formal Tests (Practical / programming and/or theory based tests) (50 %); Assignments (both written and practical) and project work (individual or group work) (50%).
DP Requirement: Not applicable
Offered in either Semester 1 or Semester 2.

This module has no supplementary exam.

Chemical Technology
Offered in the School of Chemistry and Physics

Chemical Analysis
CTEC233 P2   (27L-9T-36P-0S-67H-17R-0F-0G-4A-13W-16C)
Prerequisite Modules: CHEM110, CHEM120; MATH130, 150 or 195.
Aim: To show the role and importance of analytical chemistry in industry and society and to provide basic theory and practical skills in "wet analytical" techniques.
Content: Analytical methodology, titrimetric and gravimetric methods of analysis, errors and uncertainties in measurements, principles of calibration, industrial applications.
Practicals: Volumetric and gravimetric analysis. Treatment of experimental results. Generation of calibration curves.
Assessment: Tests (10%), practicals (30%); 3 h exam (60%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.

Environmental Analysis
CTEC313 P2   (27L-9T-36P-0S-67H-17R-0F-0G-4A-13W-16C)
Prerequisite Modules: CHEM230; either APCH231 or CTEC233.
Aim: To introduce students to strategies and techniques used in the chemical analysis of environmental samples.
Content: Reasons for environmental analysis, types of environmental sample, obtaining a representative sample, sample preservation and treatment, methods for separating and determining the analyte.
Practicals: Sampling and analysis of real systems, use of modern instrumental methods of analysis.
Assessment: Test (8%), practical reports (25%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.

Materials
CTEC323 P1   (27L-9T-36P-0S-67H-17R-0F-0G-4A-13W-16C)
Prerequisite Modules: CHEM210, 220.

Corequisite: CHEM330, 340.
Aim: To introduce students to metals, composites and polymers highlighting the role of catalysts in industry.
Content: Metals, organic polymers, composite materials, catalysis.
Practicals: Synthesis and characterization of materials.
Assessment: Tests (10%), practical reports (23%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.

Process Technology
CTEC333 P1   (27L-6T-36P-0S-73H-13R-0F-0G-5A-13W-16C)
Prerequisite Modules: CHEM220.
Aim: To introduce students to some important industrial chemical processes.
Content: Petrochemical and downstream processes, preparation of polymers, production of chemicals by fermentation processes.
Practicals: Manual and automated industrial manipulations.
Assessment: Tests (7%), practicals (26%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals, 100% attendance at tests.

Industrial Chemistry
CTEC343 P2   (27L-6T-36P-0S-68H-18R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 40% in CHEM330.
Prerequisite Modules: CHEM230.
Aim: To make students aware of the link between the traditional subjects of chemistry and chemical engineering.
Content: The industrial manufacturing process, qualitative and quantitative process flow diagrams, unit operations and unit processes, mass and energy balances on steady state systems - recycle, bypass and purge, heat exchangers and steam tables, industrial separations and applications of phase chemistry.
Practicals: Phase chemistry; problem-solving workshops; flow sheet simulation using computer software; industrial project. The module includes field trips.
Assessment: Tests (8.25%), practicals (24.75%); 3 h exam (67%).
DP Requirement: Class mark 40%, 80% attendance at practicals and workshops, 100% attendance at tests.
Students may be required to contribute to the cost of field trips.

Dietetics & Human Nutrition
Offered in the School of Agricultural, Earth and Environmental Sciences

DIET1: Weight, Diabetes, Heart Disease
DIET237 P2   (39L-0T-39P-0S-57H-20R-0F-0G-5A-13W-16C)
Prerequisite Modules: BIOC201, MPHY210, NUTR224.
Corequisite: BIOC212, HPHY210.
Aim: To develop an in-depth understanding of the causes, treatment and prevention of major lifestyle diseases.
Content: Obesity, underweight, diabetes, hypoglycaemia, coronary heart disease, hypertension.
Practicals: Problem solving.
Assessment: Tests (20%), prac evaluation (13%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at practicals.
Subminimum to pass: 40% in (exam/assessment)

Counselling Principles and Ethics in Dietetics
DIET251 P2   (47L-0T-30P-0S-41H-6R-0F-10G-6A-15W-16C)
Prerequisite Modules: NUTR224.

Aim: To introduce students to basic aspects of human science from a behavioural change theoretical perspective in conjunction with the development of basic counselling skills while adhering to a professional code of conduct and work ethic in accordance to norms prescribed by the HPCSA. This knowledge and skills are intended to enhance the ability of registered dietitians to function effectively across a range of professional settings.
Content: Behavioural change theory, paradigms and their application to health and health care practice; health, illness and behaviour, psychiatric disorders, professional development (e.g. dealing with death, dying and self-care). Professional, discipline-specific ethics.
Practicals: The practicals include case studies, compilation of disease specific counselling guides, role plays and the discussion of ethical dilemmas in the work place.
Assessment: Practical evaluation and assignments (25%), 2 tests (25%), 3 h exam (50%).
DP Requirement: 40% Class mark, 80% attendance at practicals

Diet Therapy – Surgical
DIET380 P1   (39L-0T-39P-0S-40H-20R-0F-10G-6A-15W-16C)
Prerequisite Modules: DIET237.
Aim: The purpose is to develop an in depth understanding of, and be able to safely and effectively treat hypermetabolic conditions from a dietary perspective.
Content: Contents include the hypermetabolic response, immune system response during trauma, nutrition requirements in general surgery, trauma and sepsis, specifically the dietary treatment of respiratory disorders, acute renal failure, head injuries, oesophageal surgery, gastrectomy, short bowel syndrome, necrotising enterocolitis, stomas, fistulas and burns.
Practicals: The practicals include planning dietary interventions based on clinical case studies to treat conditions related to trauma, surgery and sepsis, reviewing current literature for latest treatment trends.
Assessment: Practical evaluation (17%), 2 tests (16%), 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at practicals.

Diet Therapy - Medical I
DIET381 P2   (39L-0T-39P-0S-40H-20R-0F-10G-12A-15W-16C)
Prerequisite Modules: BIOC212; DIET237; HPHY210
Aim: Students will acquire a basic knowledge of the renal, liver, gallbladder, pancreatic disease and food allergies.
Content: Contents include renal failure (chronic, dialysis, transplant), liver failure (hepatitis, cirrhosis, end stage liver disease, transplant), gallbladder disease, pancreatic diseases and food allergy.
Practicals: The practicals include planning dietary interventions based on clinical case studies to treat conditions related to renal failure (chronic, dialysis, transplant), liver failure (hepatitis, cirrhosis, end stage liver disease, transplant), gallbladder disease, pancreatic diseases and food allergy, and reviewing current literature for latest treatment trends.
Assessment: Practical evaluation (17%), 2 tests (16%), 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at practicals.

Diet Therapy - Medical II
DIET382 P1   (39L-0T-39P-0S-40H-20R-0F-10G-12A-15W-16C)
Prerequisite Modules: BIOC201; BIOC212; DIET237; HPHY210
Aim: To develop an understanding of patient assessment, special diets in the form of consistency modifications, enteral and parenteral nutrition and to be able to safely and effectively treat conditions relating to gastrointestinal disease, cancer, malnutrition and infections in the hospital setting.
Content: Detailed patient assessment with regards to anthropometry, biochemistry and clinical data, special diets, hyperalimentation, gastrointestinal disease, cancer, in hospital treatment of severe acute malnutrition and HIV and TB in combination with other disease conditions.
Practicals: The practicals include anthropometric assessment based on clinical case studies, reviewing current literature, planning and in some instances preparing therapeutic diets for gastrointestinal disorders, cancer and severe acute malnutrition.
Assessment: Practical evaluation (17%), 2 tests (16%), 3 h exam (67%).

DP Requirement: 40% Class mark, 80% attendance at practicals

Therapy Internship in Dietetics
DIET410 PY   (6L-0T-26P-0S-145H-20R-300F-0G-3A-15W-48C)
Prerequisite Modules: Students must have passed all Level III and lower modules.
Aim: To become competent in the therapeutic nutritional care of patients in a hospital setting.
Content: Medical, surgical, and paediatric diseases and complications requiring dietary intervention.
Practicals: Students work in a hospital for the duration of the module.
Assessment: Professional competence during placement (14%), case studies (12%), therapeutic assignments (12%), pharmacology test (2%), literature review (2%), oral exam (8%); 3h exam (50%, subminimum 40%).
DP Requirement: A 40% Class mark.

Research Project in Dietetics
DIET420 PY   (10L-20T-0P-0S-260H-0R-0F-0G-A-15W-32C)
Prerequisite requirement: Students must have passed all Level III and lower modules.
Aim: This module enables students to plan, implement, analyse and document a relevant research project.
Content: A research question in the area of dietetics as agreed with a suitable supervisor.
Practicals: Research project related.
Assessment: Research project report (80%), peer assessment (2%), research proposal (9%), oral presentation (9%).
DP Requirement: Not Applicable.

Earth Sciences

Offered in the School of Agricultural, Earth and Environmental Sciences

Earth Sciences Research Project
EART730 PY   (0L-20T-50P-50S-300H-0R-0F-0G-60A-26W-48C)
Corequisite: ENVS700.
Aim: To train students in the completion of a supervised, piece of research pertinent to the Earth Sciences but dealing with an environmental context.
Content: A significant research project in the earth sciences, dealing with an appropriate environmental problem, and undertaken under the supervision of an academic member (or supervisory panel) of the University staff. Students are expected present written and oral proposals and progress reports, and to submit the research dissertation by the set date.
Assessment: Project proposal (10%), oral presentation (20%), research report (70%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Agricultural Engineering

Offered in the School of Engineering (See also AGEN)

Engineering Design
ENAG1DE P2   (20L-39T-0P-0S-10H-8R-0F-0G-3A-13W-8C)
Aim: To develop the ability to configure an appropriate design process and to select appropriate materials and manufacturing processes to carry out the construction and testing of a simple device.

Content: Philosophy of design process: problem definition, implementation, evaluation, time and project management and safety. Software tools for problem solving and engineering analysis: MATLAB (introduction to MATLAB and basic programming).

Assessment: Class mark (30%), including assignments, projects and tests, Practical exam (25%), final exam (45%).

DP Requirement: Students are required to write all class tests and complete all practicals and assignments satisfactorily, as specified in the module outline.

Introduction to Engineering Materials
ENAG1MT P2   (20L-10T-0P-0S-22H-24R-0F-0G-4A-13W-8C)

Aim: The candidates will acquire a basic understanding of materials, their structure and its influence on the physical and mechanical properties; crystallographic structures, defects in these structures and how this influences the mechanical properties; the mechanical properties of materials; and phase diagrams and how microstructures are formed.

Content: Introduction to materials, Structure of materials. Crystal imperfections. Mechanical behaviour of materials. Alloys and properties of alloys. Equilibrium phase diagrams.

Assessment: Class mark: 30% (2 tests, assignments/tutorials); 2 h exam (70%).

DP Requirement: Students are required to write all class tests and complete all tutorials and assignments satisfactorily, as specified in the module outline.

Irrigation Engineering
ENAG3EI P1   (29L-13T-39P-0S-56H-12R-6F-0G-5A-13W-16C)

Prerequisite Modules: ENCV2FL.

Aim: To equip students with the knowledge and skills required when designing irrigation systems for South African conditions.

Content: Introduction to irrigation systems and design considerations. Soil, water, atmosphere and plant continuum and how they relate to design planning. Pipe hydraulics. Design of sprinkler, micro, flood and moving irrigation systems, Types of pumps and performance characteristics, irrigation scheduling, system evaluation and maintenance.

Practicals: Irrigation design projects; laboratory and field exercises on syllabus covered.

Assessment: Two one hour tests and four assignments (40%); 3 h exam (60%).

DP Requirement: Students are required to write all class tests, attend all practicals and complete all tutorials, assignments and practical reports satisfactorily, as specified in the module outline.

Bioresources Engineering Practice Workshop
ENAG3EP P2   (0L-0T-0P-0S-0H-0R-0F-0G-0A-2W-0C)

Aim: Introduce Agricultural Engineering students to the practical aspects of Bioresources Engineering in order to give context to the modules in the Agricultural Engineering programme. Further development of IT and technical communication skills.

Content: Exposure to Bioresources Engineering in practice through site visits. IT skills required for Engineering Practice (writing, spreadsheet skills). Exposure to management issues in an operational environment, including Occupational Health and Safety, labour law, and production management.

Practicals: Four field trips.

Assessment: Coursework comprising individual assignments (100%).

DP Requirement: 100% attendance.

Forest Engineering
ENAG3FE P2   (20L-10T-3P-0S-28H-12R-3F-0G-4A-13W-8C)

Prerequisite Requirement: ENAG3PT (40%) or ENAG4BM (40%).

Aim: To acquaint students with the processes of timber harvesting, including current harvesting equipment, methods, and systems; methods of estimating logging productivity and costs; system evaluation principles; forest product markets, wood procurement systems, logging safety, harvest planning, environmental impacts, Best Management Practices, wildlife/visual concerns, regulations/legislation affecting harvesting, and forest road layout.

Content: Introduction, Forest Engineering terminology, units. Conventional ground-based harvesting systems. Steep terrain harvesting systems. Cut-to-length, tree length systems, infield chipping. Value recovery. Environmental management, environmental monitoring and certification. Best Management Practices. Strategic, tactical and operational planning. Time and motion studies, Productivity and productivity functions. Machine costing. System evaluation.

Assessment: Two one hour tests and assignments (30%); 2 h exam (70%).

DP Requirement: Students are required to write all class tests, attend all practicals and complete all tutorials, assignments and practical reports satisfactorily, as specified in the module outline.

Principles of Food Processing

ENAG3FP P1   (22L-4T-18P-0S-20H-6R-6F-0G-4A-13W-8C)

Prerequisite Requirement: ENME3TH (40%).

Aim: Students will gain knowledge of the basic principles governing the processing of different foods. Students will also be able to create process flow diagrams and use these diagrams to determine food processing related mass and energy balances and factory layout. Students will also be introduced to the management of basic food processing and related legislation.

Content: Basics of meat, vegetable, cereal, dairy, oil seed and sugar processing and packaging. Basics of factory layout, legal aspects, marketing and labelling and hygienic best practices.

Practicals: 2 Practicals, 4 field trips.

Assessment: Tutorials (2.5%), practicals (2.5%), assignment (5%), 2 tests (10% each); 2 h exam (70%).

DP Requirement: Students are required to write all class tests, attend all practicals and complete all tutorials, assignments and practical reports satisfactorily, as specified in the module outline.

Power and Traction for Agricultural Machines

ENAG3PT P1   (24L-3T-15P-0S-22H-10R-0F-0G-6A-13W-8C)

Prerequisite Requirement: ENME3TH (40%) & ENME2DM (40%).

Aim: To impart to the student skills and basic understanding of the engineering principles of agricultural power machines, how to optimize power transfer for optimum usage and to utilise these skills to solve agricultural machinery problems.

Content: Diesel engines and performance, power optimization and efficiency; power transfer transmission systems and methods like hydraulics, hitching systems, tyres and traction.

Practicals: 6 Practicals at Ukulinga research farm.

Assessment: Tutorials and practicals (5%), assignment (5%), 2 tests (10% each); 2 h exam (70%).

DP Requirement: Students are required to write all class tests, attend all practicals and complete all tutorials, assignments and practical reports satisfactorily, as specified in the module outline.

Structural Analysis and Design

ENAG3SA P2   (20L-5T-7P-0S-32H-10R-3F-0G-3A-13W-8C)

Prerequisite Requirement: ENCV2SD (40%) & ENCV2SB (40%).

Aim: Students will learn design and analysis techniques related to agricultural structures, including load analysis and stress analysis, statically determinate and statically indeterminate structures, appropriate use of steel, concrete, and timber in agricultural structures.

Content: Stress analysis. Statically determinate trusses. Bending deformation. Statically indeterminate Frames. Load analysis. Structural connections. Steel design in agriculture. Timber design in Agriculture. Concrete design in agriculture.

Practicals: Structural assessment of existing structures. Load testing.

Assessment: Class tests (15%), mini-project (15%); 2 h exam (70%).

DP Requirement: Students are required to write all class tests, attend all practicals and complete all tutorials, assignments and practical reports satisfactorily, as specified in the module outline.

Special Topics in Bioresources Engineering
ENAG3ST P1   (13L-6T-6P-0S-25H-6R-0F-0G-24A-13W-8C)
Prerequisite Requirement: 288C. Students must be in their third year.
Aim: To give students the opportunity to gain in-depth knowledge in a selected field of Bioresources Engineering and to be able to apply these new technologies and analytical techniques to solve problems.
Content: The topics will be selected from new and current fields of Bioresources Engineering and will focus on the latest technologies and analytical techniques.
Assessment: Class mark (30%), 2 h exam (70%).
DP Requirement: Students are required to write all class tests, attend all practicals and complete all tutorials, assignments and practical reports satisfactorily, as specified in the module outline.
Only for students in BSc Agricultural Engineering Programme.

Undergraduate Seminar
ENAG3US P2   (6L-0T-24P-21S-29H-0R-0F-0G-0A-13W-8C)
Prerequisite Modules: ENCH1TC.
Aim: To undertake a literature review; to prepare a seminar or report; to be able to present a seminar effectively.
Content: Individual investigations or studies by means of a literature review of any facet of Bioresources Engineering selected by the candidate and approved by the Head of School who will nominate a supervisor for the study. Technical Communication: Literature research techniques; seminar writing and presentation.
Practicals: Proper use of library resources to obtain relevant literature.
Assessment: Seminar document (70%) and oral presentation (30%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Advanced Power & Traction for Agric Machines
ENAG4AP P2   (20L-7T-9P-0S-25H-10R-5F-0G-4A-13W-8C)
Prerequisite Modules: ENAG3PT.
Aim: To impart to the student skills and advanced understanding of the engineering principles of agricultural power machines, how to optimize power transfer for optimum usage and to utilise these skills to solve agricultural machinery problems.
Content: Diesel engines performance thermodynamics, power optimization and efficiency; power transfer systems, hitching systems and weight transfer; traction aids, tractor testing.
Practicals: Tractor engine performance and fuels, tractor traction performance and implement combination, hydraulic controls and hitching systems.
Assessment: Pre-class questions (2.5%), practicals (2.5%), assignment (5%), 2 tests (10% each); 2 h exam (70%).
DP Requirement: Students are required to write all class tests, attend all practicals and complete all tutorials, assignments and practical reports satisfactorily, as specified in the module outline.

Agricultural Engineering Design Project
ENAG4ED PY   (7L-39T-39P-0S-64H-16R-0F-13G-142A-36W-32C)
Prerequisite Requirement: Student must be in a position to complete the degree at end of year.
Prerequisite Modules: ENAG3SA, ENAG3US.
Corequisite Module: ENAG4WS
Aim: To expose students to the process of identifying and solving a real-world engineering design problem in collaboration with industry, with the students assuming both the role of consulting engineers working in a team and as project managers, thus experiencing roles typical of what would be found in the workplace.
Content: Open-ended, industry related design projects which utilise principles of engineering design, engineering analysis and functional operation of engineering systems. Projects extend over two semesters and are selected, design teams formed, concepts visualised and alternatives evaluated. Emphasis on design strategies, project management, communication skills and technical writing.

Assessment: Year Mark (10%), Theoretical Design Report (30%), Final Design Report (50%), Oral Presentation of Design (10%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Bio-Production Systems and Management
ENAG4BM P1   (44L-4T-28P-0S-60H-17R-3F-0G-4A-13W-16C)
Prerequisite Requirement: ENCV2SB (40%).
Aim: Students will develop an understanding of the interaction between the environment and engineering aspects of bio-production systems. Students will understand the technical design principles underlying different processes with specific reference to agricultural and other implement design. Students will also develop skills of modelling, managing and optimising bio-systems.
Content: Principles of systems analysis, operation principles and basic equipment design for tillage, planting, chemical application, hay & forage harvesting and crop harvesting processes. Strategic planning principles, cost analysis; mechanisation planning and optimal equipment selection.
Practicals: Field trips to farmers and related conferences. Visits to major equipment suppliers.
Assessment: Tutorials (2.5%), practicals (2.5%), assignment (5%), 2 tests (10% each); 3 h exam (70%).
DP Requirement: Students are required to write all class tests, attend all practicals and complete all tutorials, assignments and practical reports satisfactorily, as specified in the module outline.

Electrical Applications for Bio-Systems
ENAG4EA P2   (20L-5T-0P-0S-39H-10R-6F-0G-0A-13W-8C)
Prerequisite Requirement: ENEL2EE (40%).
Aim: To provide students with skills to analyse problems related to electrical applications in agricultural production in order to optimise control of and use of energy and water, and be able to set up farm electrification.
Content: Appraisal of current proven systems in South Africa, definitions, resistive networks, reactive networks, electrical machines, 3-phase heating in farm structures, control systems, power factors, corrections, farm contribution systems, protection.
Practicals: Building electrical system layout, control systems.
Assessment: One test (15%), one-project (15%); 2 h exam (70%).
DP Requirement: Students are required to write all class tests, attend all practicals and complete all tutorials, assignments and practical reports satisfactorily, as specified in the module outline.

Environmental Control for Biol Commodities
ENAG4EC P2   (20L-5T-7P-0S-32H-10R-3F-0G-3A-13W-8C)
Prerequisite Requirement: ENME3TH (40%).
Aim: To enable students to understand the environmental requirements for livestock and plants and learn the important parameters in agricultural structures so that they will be able to apply engineering sciences to analyse and solve problems in environmental control.
Content: Heat transfer, mass transfer, psychrometry, energy and mass balance, environmental control in greenhouse, poultry and dairy structures.
Practicals: Visits to industrial indoor agricultural production systems (greenhouse, poultry, dairy, piggery etc.), thermal measurements of buildings, fan testing procedures.
Assessment: One test (15%), mini-project (15%); 2 h exam (70%).
DP Requirement: Students are required to write all class tests, attend all practicals and complete all tutorials, assignments and practical reports satisfactorily, as specified in the module outline.

ECSA Outcomes Portfolio
ENAG4EP PY   (0L-0T-0P-0S-0H-0R-0F-0G-0A-26W-0C)
Aim: For students to understand the requirements for, and demonstrate competence to meet, all outcomes required by Engineering Council of South Africa (ECSA) as specified in ECSA Document PE-61.

Content: The concept of outcomes and assessment criteria; ECSA Outcomes and ECSA Assessment Criteria; Bloom's Taxonomy, and its link to ECSA's outcomes, assessment criteria, and range statements; the importance of attaining competence in each of ECSA's ten outcomes; concepts of, and techniques for reflection and self-evaluation; how to structure, construct and present a professional portfolio.
Assessment: Submission of ECSA Outcomes Portfolio containing evidence of both development and competence to meet ECSA outcomes; Exit level interviews/questionnaires.
DP Requirement: Satisfactory evidence of competence to meet all ECSA outcomes.

Food Engineering Unit Operations
ENAG4FE P2   (26L-4T-18P-0S-17H-5R-3F-0G-7A-13W-8C)
Prerequisite Requirement: ENAG3FP (40%).
Aim: To equip students with an understanding of the different unit operations and related equipment used in food engineering.
Content: Post harvest handling operations, size reduction operations, processing using ambient temperature operations, processing with heat using steam and water, processing with heat using hot air, processing with heat using hot oils, processing with heat using irradiation, processing though the removal of heat.
Practicals: 2 practicals, 4 field visits.
Assessment: Tutorials (2.5%), practicals (2.5%), assignment (5%), 2 tests (10% each); 2 h exam (70%).
DP Requirement: 80% attendance of lectures, 80% attendance of practicals, complete both tests, all tuts, all assignments and obtain at least 40% class mark.

Sustainable Energy for Bio-systems
ENAG4SE P2   (20L-7T-6P-0S-24H-8R-0F-0G-15A-13W-8C)
Prerequisite Requirement: All first and second year engineering modules must be completed.
Prerequisite Modules: ENME3TH.
Corequisite: ENAG3PT, ENAG3EI.
Aim: To develop an understanding of sustainable energy systems in the Bioresources industries.
Content: Bio-Energy Systems: Generation principles and basic design. Energy Utilisation and conservation strategies in Bioresource facilities.
Practicals: Three practicals are spread throughout the semester.
Assessment: Two 45 minute tests (30%); 2 h exam (70%).
DP Requirement: Students are required to write all class tests, attend all practicals and complete all tutorials, assignments and practical reports satisfactorily, as specified in the module outline.

Selected Topics in Bioresources Engineering
ENAG4ST P2   (20L-5T-7P-0S-36H-10R-0F-0G-2A-13W-8C)
Aim: To provide the student with a flexible ability to tackle a subject of Bioresources Engineering and apply these new technologies and analytical techniques to solve problems.
Content: The topics will be selected from new and current disciplines in the field of Bioresources Engineering and will focus on the latest technologies and analytical techniques.
Assessment: Practicals and assignments (5%), tests (25%), final report (70%).
DP Requirement: Students are required to write all class tests, attend all practicals and complete all tutorials, assignments and practical reports satisfactorily, as specified in the module outline.
This module has no supplementary exam.

Soil and Water Conservation Engineering
ENAG4SW P2   (20L-13T-0P-0S-28H-12R-3F-0G-4A-13W-8C)
Prerequisite Requirement: HYDR210; ENCV2FL.
Aim: To provide students with an understanding of the principles of soil and water conservation and to design and analyse soil and water conservation structures.

Content: Land degradation. Processes and mechanics of erosion. Principles of open channel flow. Runoff control planning, Planning, design, construction and maintenance of lined and vegetated open channels. Design of conservation structures.

Practicals: Field visits.

Assessment: Assignments and two one hour tests (40%); 2 h exam (60%).

DP Requirement: Students are required to write all class tests, attend all practicals and complete all tutorials, assignments and practical reports satisfactorily, as specified in the module outline.

Vacation Work

ENAG4VW PC   (0L-0T-0P-0S-0H-0R-0F-0G-0A-12W-0C)

Aim: To provide students with experience in a realistic working environment thus enabling them to consider their studies in context and to gain a sense of perspective into their university studies.

Content: This is a Duly Performed requirement for the BSc Eng (Agricultural) degree. Vacation work is to be arranged and undertaken by students during the course of the degree in fields relevant to Agricultural Engineering. A total of 12 weeks must be accumulated. A report on the work conducted is to be submitted to the department within one month of the conclusion of each vacation work period, together with a certificate of progress from the firm concerned, in which the actual period is also stated.

Assessment: Reports acceptable in terms of scientific method, synthesis, computer use and presentation.

DP Requirement: Satisfactory completion of vacation work reports.

Workshop Course

ENAG4WS PC   (0L-0T-0P-0S-0H-0R-0F-0G-0A-1W-0C)

Corequisite: Eligibility to register for ENAG4BD.

Aim: Candidates to acquire an appreciation and basic skills in common fabrication techniques, and familiarise themselves with the structure and function of commonly used workshop equipment.

Content: This is a Duly Performed requirement. Practical workshop instruction and experience includes workshop safety, workshop techniques including welding and machining, and the manufacture of machine components, both individually and in groups.

Assessment: Students attend week-long course and submit a report.

DP Requirement: Satisfactory completion of training and workshop report.

Chemical Engineering

Offered in the School of Engineering

Chemical Engineering Principles 1

ENCH1EA H1   (20L-14T-0P-8S-22H-10R-0F-0G-6A-13W-8C)

Aim: To familiarize students with chemical engineering plant flowsheets; the types of unit operations involved; the need for accounting for material and energy within a process plant; and the concepts of conservation of mass and energy within those unit operations.

Content: What is chemical engineering? Systems of units, problem solving skills, block and process flow diagrams, unit operations, conservation of mass and energy, single unit material balances, stoichiometry and reactive material balances. Fundamentals (PT), forms of energy and the 1st law of thermodynamics, simplified specific heat capacities and their use, heats of mixing, solution and reaction, reactive energy balances.

Assessment: One test (10%), one quiz (5%), project (10%), 3 h exam (75%).

DP Requirement: 80% attendance at tutorials. Satisfactory completion of the project.

Chemical Engineering Principles 2

ENCH1EB H1   (20L-11T-0P-0S-32H-8R-3F-2G-4A-13W-8C)

Prerequisite Requirement: 40% in ENCH1EA

Aim: To familiarize students with the techniques of mass and energy balancing and their use in relation to the operation of chemical engineering processes.

Content: Material balances on multiple unit processes, recycles, multiple independent chemical reactions, element balances; enthalpy: concepts and temperature dependence, specific heat capacity and use of steam tables; energy balances on closed systems and open systems at steady state; phase changes; heat exchangers (concept, energy balances); heats of mixing and solution, heats of formation and Hess's Law to calculate heats of reaction; reactor energy balancing, isothermal and adiabatic reactors.

Assessment: Test/Quizzes (15%), project (15%); 2 h exam (70%).

DP Requirement: 80% attendance at tutorials and to complete the project satisfactorily, as specified in the module outline.

Technical Communication for Engineers

ENCH1TC H1 P1   (10L-15T-0P-13S-20H-16R-0F-0G-6A-13W-8C)

Aim: To develop students' discourse competence in technical English with the intention of improving their ability to read a range of texts, to write genres important to Engineering students, and to give oral presentations on Engineering topics.

Content: Module content is a short research project relating to Engineering. This is a practical module in which students improve their writing through practical experience of a number of different kinds of writing, students will be supported in their reading in order to improve their ability to extract meaning from Engineering-related texts taken from a range of genres and to use these sources appropriately in writing their own texts in the appropriate academic register. In addition students gain experience in presenting a short talk.

Assessment: Continuous assessment (written assignments, tests and oral presentation).

DP Requirement: Not applicable.

This module has no supplementary exam.

Chemical Engineering Fundamentals

ENCH2EF H2   (39L-12T-0P-0S-63H-40R-0F-0G-6A-13W-16C)

Prerequisite Requirement: ENCH1EB (40%).

Aim: To study fundamental concepts in heat, mass and momentum transfer.

Content: Introduction to fluids, types of fluids (Newtonian, Non-Newtonian), flow of fluids. Static fluids, pressure, pressure measurement. Laminar and turbulent flow in Fluids. Microscopic and macroscopic energy balances in fluids. Introduction to heat transfer by conduction, convection and radiation, Fourier's Law of conduction. Heat transfer at steady state through single and multiple layers. Critical thickness of insulation. Natural and forced convection. Overall heat transfer co-efficient. Types of heat exchangers. Introduction to mass transfer by diffusion, Fick's Law of diffusion, diffusion in a variety of situations, prediction of diffusion co-efficients, chemical potential as the true driving force for mass transfer. The analogous nature of fluid, heat and mass transfer; Reynolds analogy, Chilton-Colburn analogy.

Assessment: Tests and quizzes (25%); 3 h exam (75%).

DP Requirement: 80% attendance at tutorials.

Experimental Techniques and Measurements

ENCH2ET H2   (11L- 0T-32P-8S-62H-20R-0F-24G-3A-13W-16C)

Prerequisite Requirement: ENEL2EE (40%), ENCH2MB (40%).

Corequisite: ENCH2EF.

Aim: Understanding experimental methods and applying these in an engineering environment; enabling the student to work as part of a team; to equip the student to communicate effectively both orally and in writing.

Content: Experimental techniques and measurements; report writing; sensor terminology; basic statistical parameters; signal conditioning; thermal level, pressure & flow sensors; piping and instrumentation diagrams.

Practicals: Calibration techniques; measurement on core chemical engineering units; evaporators, flow devices heat exchangers; sensors and data acquisition equipment.

Assessment: Pre-practicals (5%); seminars (20%); group report (15%); group assessment (5%); individual report (20%); test (35%).

DP Requirement: Satisfactory completion of all pre-practicals and practicals; submission of satisfactory reports; presentation at the seminar; and attendance at the test.
There is no written exam for this module.

Mass and Energy Balances
ENCH2MB H1   (20L-14T-0P-0S-24H-17R-0F-0G-5A-13W-8C)
Prerequisite Requirement: 40% in ENCH1EB
Aim: To equip the student with problem solving skills relevant to complex material and energy balances in flowsheeting problems using the principles of conservation of energy and of mass for the evaluation of relevant properties of materials.
Content: Use of thermodynamic principals to assess changes in system properties. State variables, P-V-T properties of fluids. Single component, multi-phase systems and phase diagrams. van der Waals EoS, Virial EoS, Cubic EoS, generalised compressibility charts. Degrees of freedom, underspecification and over-specification of problems. Determining an optimal problem solving sequence. Use of matrix inversion to solve sets of simultaneous equations. Determining dependence or independence of chemical reactions in reactors with multiple simultaneous chemical reactions. Material and energy balancing for multiple component, multi-phase systems. Simultaneous energy and mass balances, psychrometry. Solution of implicit mass and energy balance problems using computers.
Assessment: Tests and quizzes (30%); 2 h exam (70%).
DP Requirement: 80% attendance at tutorials.

Materials of Construction
ENCH2MS H2   (20L-5T-0P-0S-30H-20R-0F-0G-5A-13W-8C)
Prerequisite Requirement: 40% in CHEM171 or CHEM120.
Aim: To introduce students to materials available for engineering applications, and develop the ability to select materials according to their properties.
Content: Phase diagrams. Mechanical properties of materials. Corrosion. Ceramics and refractories. Composite materials. Polymers. Stainless steels. Design codes and safety codes.
Assessment: Test (15%), Quiz (10%); 2 h exam (75%).
DP Requirement: 80% attendance at tutorials.

Oil & Mineral Processing
ENCH2OM H1   (20L-5T-0P-0S-24H-25R-0F-0G-6A-13W-8C)
Prerequisite Requirement: 40% in ENCH1EA.
Aim: To provide an overview of the mineral and petroleum industry in the country. To undertake calculations on grinding and be able to design milling circuits. To convert information on crude oil into a production plan and undertake blending calculations.
Content: An overview of South Africa's minerals industry; terminology; storage of minerals, particle size measurements and modelling of data; grinding; effect of classification on grinding efficiency; material balances; general flowsheets. Terminology; characterisation of oils; discussion of typical refinery flowsheets; description of the major unit operations; basic calculations in blending.
Assessment: Tests, quizzes, one assignment (25%); 2 h exam (75%).
DP Requirement: 80% attendance at tutorials. Satisfactory completion of 1 assignment.

Thermodynamics 1
ENCH2TD H2   (20L-8T-0P-0S-30H-16R-0F-0G-6A-13W-8C)
Prerequisite Requirement: 40% in MATH238.
Prerequisite Modules: ENCH2MB.
Aim: To enable the candidates to be competent in the following areas of thermodynamics: solution thermodynamics; gas compression; liquefaction of gases and refrigeration.
Content: Flow process analysis: 2nd law, entropy, isentropic processes; compressors/turbines, throttling, liquefaction of gases and refrigeration. Properties of solutions: Introduction to vapour-liquid equilibrium, VLE Qualitative behaviour,

simple models for VLE, modified Raoult's law, VLE from K relations, pure species phase equilibrium, Gibbs energy, pure component VLE, thermodynamics of mixtures, partial properties, Gibbs-Duhem equation, thermodynamics idealgas mixtures, fugacity and fugacity coefficient (pure species), fugacity and fugacity coefficient (species in solution); generalised correlation for fugacity coefficient, ideal solution; excess properties.

Assessment: Test, quizzes and assignment (30%), 2 h exam (70%).

DP Requirement: 80% attendance at tutorials. Satisfactory completion of assignment.

Workshop Training

ENCH2WS HC   (0L-0T-0P-0S-0H-0R-0F-0G-0A-1W-0C)

Aim: Candidates to acquire an appreciation and basic skills in common fabrication techniques, and familiarise themselves with the structure and function of common chemical engineering equipment items.

Content: This is a Duly Performed requirement. Practical workshop instruction and experience includes methods of measurement, jointing & welding, material forming, heat treatment, precision drilling, shaping, turning, etc., with fitting (assembly/dissembly). The use of common hand tools, lathes, and drilling & milling equipment will be covered.

Practicals: 100%

Assessment: Students must earn a duly performed certificate.

DP Requirement: Satisfactory completion of training.

Chemical Engineering Practicals 2

ENCH3CP H2   (5L-0T-18P-0S-40H-4R-0F-10G-3A-13W-8C)

Prerequisite Modules: ENCH2ET.

Aim: To equip the student with skills to analyse and interpret experimental data, in addition to being able to undertake experimental studies. To enable the student to use common statistical methods. To enable the student to work as part of a team in conducting and reporting on tasks scheduled. To equip the student to communicate effectively both orally and in written format.

Content: Design of experiments, analysis of experimental data, regression analysis and error reporting.

Practicals: Residence time distribution (illustrates concepts of differing time taken by fluid to flow through apparatus); mass transfer across an interface in a stirred cell (illustrated concepts of mass transfer); fluidisation (illustrates and tests concepts of fluidisation theory); cooling tower (demonstrates operation of cooling tower and tests cooling tower theory); pump and fan (illustrates concepts related to movement of fluids) and vapour-liquid equilibrium (demonstrates use of still to obtain VLE data).

Assessment: Pre-practicals (5%); Seminar presentation (20%); Group report (10%); Individual report (20%); Group assessment (5%). 2 h practical test (40%).

DP Requirement: Satisfactory completion of post-practicals and submission of practical reports as specified in the module outline.

This module has no supplementary exam.

Chemical Engineering Design

ENCH3ED H2   (6L-30T-4P-0S-120H-0R-0F-0G-0A-13W-16C)

Prerequisite Modules: ENCH2MB, ENCH3FS, ENCH3HE, ENCH3SL.

Aim: To give an appreciation of the multi-disciplinary nature of design and to consolidate theoretical knowledge through application to a simulated practical design problem.

Content: Theoretical knowledge gained in the Fluid Mechanics and Heat Transfer modules is applied to a design problem containing some open-ended aspects. The design must be optimized to satisfy the plant specifications whilst simultaneously complying with the imposed constrains. Simplified cost estimation and HAZOP techniques are utilized. This module focuses on the design of a pipe network and a heat exchanger.

Practicals: A plant visit to an industrial environment to observe process units and extract relevant data/information.

Assessment: Progress report (10%); Final Design Report (90%).

DP Requirement: Not applicable.

Subminimum requirement: In order to assist students in the development towards the ECSA ELOs, those reports which would otherwise pass but are deficient in one of the outcomes required in the final assessment will be returned

for resubmission. If the deficiencies are not addressed as per programme requirements in the resubmission, the student would have deemed to fail the module at 48%.
This module has no supplementary exam.

Fluid and Solids Transport
ENCH3FS H1   39L-12T-0P-0S-62H-41R-0F-0G-6A-15W-16C
Prerequisites: 40% in ENCH2EF, 40 % in ENCH2OM
Aim: To develop a thorough understanding of fluid flows and solids handling, and sound computational techniques for solving relevant design unit operations problems.
Content: Fluid Mechanics through piping and pumping systems (Macroscopic Energy and Momentum Balances, Compressible Flow, Navier-Stokes Equations, Non-Newtonian Fluid Flows, Dimensional Analysis in Fluid Mechanics, Pumps). Flow through Porous Media (Principles of Flow through Porous Media, Filtration, Fluidisation). Settling and Sedimentation (Particle Dynamics in Settling, Sedimentation). Crystallisation
Assessment: Two tests (20%), group assignment (10%), 3-hour exam (70%).
DP Requirement: 80% attendance at tutorials and satisfactory completion of assignment.

Heat Transfer
ENCH3HE H1   (39L-12T-0P-0S-61H-36R-0F-6G-6A-13W-16C)
Prerequisite Requirement: 40% in ENCH2EF.
Aim: To enable candidates to design heat-exchange units for a given application and to understand problems in thermal management.
Content: Conduction: solving two-dimensional steady state problems using analytical, graphical and numerical methods. Convection: boundary layer concept, boundary layer analogies, natural and forced convection correlations. Heat transfer with phase change: boiling and condensation. Heat exchanger calculations using LMTD and NTU concepts. Humidification and drying: drying rate curves, types of dryers, Cooling tower calculations. Pinch analysis: basic concepts, designing for MER. Evaporators: single and multiple effect evaporator calculations.
Assessment: Tests, quizzes, and one assignment (total 25%); 3 h exam (75%).
DP Requirement: 80% attendance at tutorials and to complete assignment satisfactorily, as specified in the module outline.

Mass Transfer
ENCH3MT H2   (39L-12T-0P-0S-65H-38R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 40% in ENCH2EF and 40% in ENCH3TH.
Aim: To develop the skills of design and performance assessment in continuous and batch distillation, gas absorption, leaching and liquid-liquid extraction.
Content: Industrial separation techniques; cascades; absorption, stripping; graphical methods; stage efficiency; mass transfer coefficients; rate-based methods; binary distillation, equilibrium methods and rate-based methods; short cut estimates; batch distillation; solvent extraction; graphical analysis, equilibrium stages; solvent to feed ratios; reflux; leaching.
Assessment: Two tests, assignment (30%); 3 h exam (70%).
DP Requirement: 80% attendance at tutorials. Satisfactory completion of assignment.

Process Modelling & Optimisation
ENCH3PO H2   (39L-12T-0P-6S-55H-42R-0F-0G-6A-13W-16C)
Prerequisite Modules: ENCH3HE, ENCH3FS, MATH354.
Corequisite: ENCH3MT or ENCH3RT.
Aim: To enable the student to express the known material and energy balance as well as rate equations that govern physical and chemical processes in a mathematical form containing all the information necessary for process simulation. To develop an understanding of the techniques used to optimize chemical processes and familiarize the student with existing commercial optimization solvers.
Content: Rules of the model building process, model hierarchy; derivation of models for lumped and distributed parameter systems; numerical solving of nonlinear algebraic equations; solution techniques for ordinary differential

equations (ODE's); linearization of nonlinear ODE's, stability analysis; two-point boundary-value problems, techniques for systems with tridiagonal matrices; numerical techniques for partial differential equations; optimization methods, constrained problems and penalty functions, elements of non-integer and integer linear programming. Matrix approach in regression analysis.
Assessment: MATLAB assignment, two tests (30%); 3 h exam (70%).
DP Requirement: 80% attendance at tutorials. Satisfactory completion of all assignments.

Reactor Technology Fundamentals
ENCH3RT H2   (39L-12T-0P-8S-65H-30R-0F-0G-6A-13W-16C)
Prerequisite Modules: MATH238 & ENCH2EF.
Aim: To communicate the principles and calculation of reaction rates, yields and compositions in well-defined reaction systems including mixed and plug-flow reactors with heat transfer, non-ideal reactors, and catalytic systems.
Content: Reaction stoichiometry, kinetics and thermodynamics. Isothermal ideal (batch, semibatch, mixed- and plugflow) reactors - design equations. Multireaction systems. Variable-volume reactions. Nonisothermal reactors. Nonideal flow reactors and RTD analysis. Kinetics of catalytic reactions (catalyst characterization, physical and chemical adsorption, intrinsic kinetics, intraparticle diffusion, deactivation). Multiphase reactors.
Assessment: Two tests, assignment (25%); 3 h exam (75%).
DP Requirement: 80% attendance at tutorials. Satisfactory completion of assignment.

Safety and Loss Prevention
ENCH3SL H1   (20L-14T-0P-0S-30H-10R-0F-0G-6A-13W-8C)
Prerequisite Requirement: 40% in ENCH2MS.
Aim: To instil an awareness and understanding of safe practices in design and operation of chemical engineering processes in all stages of chemical engineering design.
Content: Hazard evaluation procedures. Chemical reaction hazards. Toxicology. The main environmental problems we are facing today. Safety in process design. Impact of engineering activity on the social, industrial and physical environment, impact of technology on society and environment, occupational and public health and safety.
Assessment: Tests & assignments (30%); 2 h exam (70%).
DP Requirement: 80% attendance at tutorials, 4 assignments out of 6 submitted assignments must be accepted.

Thermodynamics 2
ENCH3TH H1   (20L-6T-0P-0S-33H-15R-0F-0G-6A-13W-8C)
Prerequisite Requirement: 40% in ENCH2TD.
Aim: To is enable the candidates to be competent in the following areas of thermodynamics: Vapour-liquid equilibria; Topics in phase equilibria and chemical reaction equilibria.
Content: Vapour-liquid equilibrium: liquid phase properties from VLE data, Excess Gibbs energy models, property changes of mixing, phi-phi and gamma-phi approaches to data correlation and prediction, flash calculations. Using ASPEN Plus for evaluating thermodynamic properties, prediction and regression of VLE data.
Topics in phase equilibria: equilibrium and stability; liquid-liquid (binary and ternary) equilibria; vapour-liquid-liquid equilibria; solid-liquid equilibria; solid vapour-equilibria. Chemical Reaction equilibria: the reaction coordinate, equilibrium criteria; equilibrium constant and equilibrium constant including effect of temperature, relation of equilibrium constants to composition, equilibrium conversion for single reactions, phase rule and Duhem's theorem for reacting systems, multi reaction equilibria.
Assessment: Tests, quizzes, one assignment (30%), 2 h exam (70%).
DP Requirement: 80% attendance at tutorials. Satisfactory completion of assignment.

Applied Biochemical Engineering
ENCH4AB H2   (10L-3T-6P-10S-34H-13R-0F-0G-4A-13W-8C)
Prerequisite Requirement: All first and second year modules.
Aim: To acquire specialised skills in the application of biochemical engineering techniques.

Content: The concepts introduced in Biochemical Engineering will be expanded and applied to industrial processes. Microbe/microbe interaction; microbe/environment interaction; anaerobic digestion; activated sludge process; brewing; commercial amino acid production; bio-mineral processing. Independent Learning Section: Students will be required to research case studies.

Assessment: One test, one quiz, one practical, assignment (30%); 2 h exam (70%).

DP Requirement: 80% attendance at tutorials, completion of the self-study assignment (with 50% pass), and completion of the practical satisfactorily, as specified in the module outline.

Subminimum Requirements: The assignment must be passed as part of meeting ECSA ELO9 (independent learning ability).

Biorefinery Concept and Green Technologies

ENCH4BG H1   (9L- 4T-0P-13S- 26H-20R-5F-0G-3A-13W-8C)

Prerequisite Requirement: All 1st and 2nd year modules complete.

Prerequisite Modules: CHEM251.

Aim: To introduce the biorefinery concept and green technologies. To provide the knowledge and tools to develop biorefinery strategies and to better understand emerging biorefinery technologies and their design/implementation in a business strategy.

Content: The differences between biorefineries and green technologies. Schematics for converting biomass processing industries into biorefineries. The products and materials generated from such technologies. A simple life cycle analysis on the technologies and the issues that need further research.

Practicals: Visit to a pulp mill or facility that practices biorefining technologies.

Assessment: Test (10%), self-study written assignment, and class presentation on self-study assignment (30%); 2h exam (60%).

DP Requirement: Presentation of self-study assignment (with a 50% pass); satisfactory completion of assignments (to achieve a mark of 50% or more); attendance at 80% of lectures and tutorials; attendance at the plant visit/tour

Subminimum Requirements: The self-study presentation and the assignment must be passed as part of meeting ECSA ELO9 (independent learning ability) as the final assessment point.

Chemical Engineering Topics 1

ENCH4CA H1   (10L-6T-0P-10S-28H-20R-0F-0G-6A-13W-8C)

Prerequisite Requirement: Will depend upon subject.

Aim: An optional subject to provide students with specialised knowledge that is not in the syllabus.

Content: Recent developments in chemical engineering science and technology, typically given by a visiting academic or new staff member. An independent study section based on investigation of case studies will be included.

Assessment: One test, assignment; 2 h exam (weighting dependent upon subject).

DP Requirement: 80% attendance at tutorials. Satisfactory completion of all assignments.

The module must be passed as part of meeting ECSA ELO9 (independent learning ability) as the final assessment point.

Chemical Engineering Topics 2

ENCH4CB H2   (10L-6T-0P-10S-28H-20R-0F-0G-6A-13W-8C)

Prerequisite Requirement: Will depend upon subject.

Aim: An optional subject to provide students with specialised knowledge that is not in the syllabus. To assesses independent learning ability.

Content: Recent developments in chemical engineering science and technology, typically given by a visiting academic or new staff member. An independent study section based on investigation of case studies will be included.

Assessment: One test, assignment; 2 h exam (weighting dependent upon subject).

DP Requirement: 80% attendance at tutorials. Satisfactory completion of all assignments.

The module must be passed as part of meeting ECSA ELO9 (independent learning ability) as the final assessment point.

Coal Technology & Gasification
ENCH4CG H1   (11L-6T-3P-10S-21H-25R-0F-0G-4A-13W-8C)
Prerequisite Requirement: All first and second year modules.
Aim: To communicate the importance, origin, types, properties, handling/storage and the cleaning of coal, major coal processes, and the environmental impact from coal-fired furnaces. To develop independent learning ability.
Content: Coal and its constituents, action of heat, chemicals and solvents. Composition and classification of coal. Treatment and storage of coal. Cleaning of coal. Combustion of coal, types of boiler furnace, gas turbines, fuel cells. Carbonization of coal, coal gasification, water gas, Lurgi gasifier, coal and coke analysis, coal tar and tar fuels, hydrogenation of coal. Independent learning section: Students are required to investigate case studies for new developments in coal processing.
Practicals: Froth flotation of coal and ash analysis of coal.
Assessment: Test (20%), assignment (10%) (Based on self-study); 2 h exam (70%).
DP Requirement: 80% attendance at tutorials. Satisfactory completion of the self-study assignment (with a 50% pass) and completion of the practical.
Subminimum Requirements: The self-study presentation and the assignment must be passed as part of meeting ECSA ELO9 (independent learning ability) as the final assessment point.

Process Dynamics & Control
ENCH4DC H1   (39L-9T-12P-0S-54H-40R-0F-0G-6A-13W-16C)
Prerequisite Modules: ENCH2ET, ENCH2MB & ENCH3ED.
Aim: To configure basic & advanced control schemes.
Content: Modelling: mass/energy balances; integration; linearisation. Instruments: sensors; transmitters; actuators. Loops: ratio; cascade; override; split-range; adaptive; feedforward. Advanced: DMC; Smith predictor; advanced level control. Laplace: various inputs to 1st & 2nd order systems; characteristic equation; root locus. Frequency: Nyquist, Bode & Nichols; stability; phase & gain margin; P, PI & PID multivariable: Stability; interaction; decoupling; loop-pairing.
Practicals: 1) Reaction-curve tuning of a pump-tank controller; 2) Frequency-response tuning of interacting tanks control.
Assessment: Tests and quizzes (20%), 2 practicals (10%); 3 h examination (70%).
DP Requirement: 80% attendance at tutorials and to complete all practicals satisfactorily, as specified in the module outline.

Design Project
ENCH4DP H2   (0L-36T-0P-0S-130H-20R-4F-130G-0A-13W-32C)
Prerequisite Modules: ENCH4RT, ENCH4MT & ENCH4DC.
Corequisite: ENCH4PE.
Aim: To acquire skills, confidence & vision for a large industrial design project.
Content: Complete group-based design project based on an industrial problem. Process design: flowsheet; kinetics; equilibria; mass/energy balances by computer simulation; pinch optimisation; equipment sizing; environmental issues. Operation: instrumentation; control loops; ergonomics; materials handling; operability study and hazard analysis. Engineering: drawings; specification sheets; materials of construction; standards; OSH Act; hazardous areas classification. Project management. Economics.
Assessment: Group technical memorandum (7.5%), Individual Technical Memorandum (7.5%); final design report at end (Group contribution: 30%, individual contribution 55%).
DP Requirement: Not applicable.
Subminimum requirements: The final Report must be passed as a final assessment point for meeting **ECSA ELO1 (Problem solving),** ELO3 (engineering design), **ELO7 (sustainability and impact of engineering activity),** ELO8 (team and individual work), ELO 10 (engineering professionalism) and ELO11 (engineering management).
T**his module has no supplementary exam**.**This module has no supplementary exam.**

Environmental Impact Assessment
ENCH4EI H2   (10L-6T-0P-10S-22H-20R-8F-0G-4A-13W-8C)

Prerequisite Modules: ENCH3SL.

Aim: To provide an understanding of the issues in environmental impact assessment for the land-use planning required for major developments.

Content: Introduction: provision of resources & services including economic benefits; putting a financial value on ecosystems. How we deal with adverse environmental impacts; EIA legislation in South Africa; EIA tools & techniques; EIA case studies; strategic environmental assessment; SEA case study; environmental management plans; environmental audits. *Independent learning section:* students are required to generate environmental management plans & conduct environmental audits on a range of South African case studies during the self-study section.

Assessment: 2 assignments, 1 test (30%); 2 h exam (70%).

DP Requirement: 80% attendance at tutorials, completion of the self-study assignments (with a 50% pass).

The module must be passed as part of meeting ECSA ELO9 (independent learning ability) as the final assessment point.

Extractive Metallurgy

ENCH4EM H2   (10L-6T-3P-10S-21H-20R-5F-0G-5A-13W-8C)

Prerequisite Requirement: All first and second year modules and 40% in ENCH3TH.

Aim: To provide students with an understanding of methods used to extract and purify metals, and to estimate extraction efficiency. To develop independent learning ability.

Content: Hydrometallurgical processes: theory and application of leaching, precipitation, solvent extraction and electrorefining and electro-winning. Pyrometallurgy: use of the Ellingham diagram. Mass balance calculations. Plant equipment. Slags and refractories. Application of pyrometallurgy and hydrometallurgy by the South African mineral processing industry. *Independent learning section:* students are required to investigate and present certain portions of the module to the class. The presentations will be assessed and the subject matter will be included in the test and the final examination.

Practicals: Copper solvent extraction practical. Visit to an industrial plant (subject to availability of suitable site).

Assessment: Test, presentation and assignment (total 30%); 2 h exam (70%).

DP Requirement: 80% attendance at tutorials, completion of the self-study presentation (with a 50% pass) and completion of the assignment.

Subminimum Requirements: The self-study presentation and the assignment must be passed as part of meeting ECSA ELO9 (independent learning ability) as the final assessment point.

Laboratory/Industry Project 1

ENCH4LA H1   (0L-0T-60P-0S-95H-0R-0F-0G-5A-13W-16C)

Prerequisite Requirement: Students must be in a position to complete the degree within the year.

Aim: A practical investigation into either an area of current research within the School, or an industrially relevant project linked to local industry.

Content: A practical investigation into either an area of current research within the School, or an industrially relevant project linked to local industry.

Practicals: Test work must be done and written up as a formal report.

Assessment: Oral presentation (15%), Supervisor assessment (15%), Poster Presentation (10%), Report (60% comprising 50% for project proposal and investigations, experimentation and analysis aspects and 50% for communication aspects).

DP Requirement: 50% or more in mid-term presentation.

Subminimum Requirements: The oral presentation must be passed as part of meeting ECSA ELO6 (professional and technical communication). The final report must be passed as part of meeting ECSA ELO4 (investigation, experimentation and data analysis) and ELO6 (professional and technical communication) as final assessment points. Provided a pass mark is achieved for the report, a report not meeting the exit level outcomes will be returned for attention before board consideration. If accepted, the module will be passed at 50%, else failed at 48%.

This module has no supplementary exam.

Laboratory/Industry Project 2

ENCH4LB H2   (0L-0T-30P-0S-48H-0R-0F-0G-2A-13W-8C)

Prerequisite Requirement: Students must be in a position to complete the degree within the year.
Aim: To give students experience in planning and executing current research test work.
Content: A practical investigation into either an area of current research within the School, or an industrially relevant project linked to local industry.
Practicals: Test work must be done and written up as a formal report.
Assessment: A written report, project presentation and/or poster design (100%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Engineering Management & Labour Relations
ENCH4ML H1   (20L-2T-0P-0S-25H-14R-0F-10G-5A-13W-8C)
Prerequisite Requirement: All first, and at least 96 credits of second year modules, must be completed.
Aim: To provide students with the managerial and legal knowledge and skills they require in their early professional years.
Content: Functions of a manager. Decision-making, strategic management, safety and quality management, ethics in the workplace, professional development, authority, responsibility and accountability. The motivation and guidance of staff, leadership style, effective time management, conflict resolution. Legislation which regulates and impacts on relations and interaction at work (Basic Conditions of Employment Act, the Labour Relations Act and Employment Equity Act) including negotiations, union organization, strikes and settlements.
Assessment: Assignment and two tests (30%); 2 h exam (70%).
DP Requirement: 80% attendance at tutorials and to complete all assignments and tests satisfactorily, as specified in the module outline.
Subminimum Requirements: The assignment must be passed as part of meeting ECSA ELO8 (interdisciplinary, team and individual work) and ELO11 (engineering management).

Mineral Processing
ENCH4MP H1   (10L-6T-6P-10S-24H-20R-0F-0G-4A-13W-8C)
Prerequisite Requirement: All first and second year modules must be completed.
Prerequisite Modules: ENCH3MP
Aim: To provide students with an understanding of the methods used to concentrate minerals and an ability to assess and optimise plant performance. To develop independent learning ability.
Content: Introduction to ore forming processes. Chemistry of froth flotation and analysis of collection efficiency. Simulation of flotation circuits. Examples of flotation circuits. Sampling theory. Gravity concentration techniques and theory. Washability tests and prediction of dense medium separation efficiency. Introduction to magnetic and electrostatic separators. Application of mineral processing in South Africa. Independent learning section: Students are required to investigate and present certain portions of the module in the class. The presentations will be assessed and the subject matter will included in the test and final examination.
Practicals: Batch flotation practical.
Assessment: One test, presentation, practical assignment (total 30%); 2 h exam (70%).
DP Requirement: 80% attendance at tutorials, completion of the self-study assignment (with a 50% pass) and completion of the practical assignment.
Subminimum Requirements: The self-study presentation and the assignment must be passed as part of meeting ECSA ELO9 (independent learning ability) as the final assessment point.

Advanced Mass Transfer
ENCH4MT H1   (20L-6T-3P-0S-12H-31R-0F-3G-5A-13W-8C)
Prerequisite Modules: ENCH3MT.
Aim: Candidates will analyze, model and design advanced mass transfer operations with special reference to conceptualization and computer simulation of unit operations.
Content: Multi-component phase equilibria; isothermal and adiabatic flash; bubble and dew points; equation-tearing procedures for multi-component distillation column analysis and simulation; short-cut techniques; enhanced distillation; multi-component batch distillation; membrane separation; adsorption; ion exchange; chromatography.

Assessment: One test and one open-ended assignment (15%), one computer based test (25%); 2 h exam (60%).
DP Requirement: 80% attendance at tutorials and to complete assignment satisfactorily, as specified in the module outline.
Subminimum Requirements: The ASPEN based simulation test must be passed as part of meeting ECSA ELO5 (engineering methods, skills and tools, including information technology). Students who do not achieve a mark of 50% or more on the ASPEN test on the first attempt will be permitted to write a make-up test. The module must be passed as part of meeting ECSA ELO2 (application of scientific and engineering knowledge), and ELO5.

Projects & the Environment
ENCH4PE H2   (20L-6T-0P-10S-25H-14R-0F-0G-5A-13W-8C)
Prerequisite Requirement: 40% in ENCH3ED.
Co-requisite: ENCH4DP
Aim: Candidates will learn how to perform economic analyses of projects and become acquainted with project management tools. Furthermore, they will be exposed to environmental legislation and what tests are required to ensure environmental compliance.
Content: Costing of new projects, income statement, balance sheet, budgeting, cost estimation, discounted cash flow analysis, financial feasibility analysis, return on investment, net present value, internal rate of return. Project plan, scheduling, work breakdown structure, critical path method, time-cost trade-offs. National Environmental Management Act, process calculations, treatment of industrial waste water, COD calculations.
Assessment: Two tests and assignment (30%); 2 h exam (70%).
DP Requirement: 80% attendance at tutorials and tests and satisfactory completion of the assignment as specified in the module outline.

Paper Making Technology
ENCH4PM H2   (10L-6T-2P-10S-21H-20R-8F-0G-3A-13W-8C)
Prerequisite Requirement: All 1st and 2nd year modules must be completed.
Aim: To introduce candidates to papermaking science & technology. To develop independent learning ability.
Content: Overview of the pulp and paper industry, the nature of wood, paper testing, stock preparation, paper chemistry, dry-end operations, recycled fibre operations, environmental issues and cleaner production in the paper industry, paper machine economics. Students are required to review and analyse case studies and literature on some of these components of the module.
Practicals: Physical testing of paper handsheets.
Assessment: One hour test (10%), class presentation of self-study assignment (10%), written assignment (5%), laboratory practical (5%); 2 h exam (70%).
DP Requirement: Complete assignment, and laboratory practical satisfactorily, completion of self-study assignment (with 50% pass). At least70% attendance at lectures. Attendance at mill tour.
Subminimum Requirements: The self-study presentation and the assignment must be passed as part of meeting ECSA ELO9 (independent learning ability) as the final assessment point.

Petroleum & Synthetic Fuel Processing
ENCH4PP H2   (10L-6T-3P-10S-21H-25R-0F-0G-5A-13W-8C)
Prerequisite Requirement: All first and second year modules must be completed.
Aim: To acquire an appreciation of the major processes in this industry. Calculation and decision making skills.
Content: Petroleum Refining: Reserves; characterization; storage systems, safety; refinery processing; visbreaking; catalytic reforming and isomerization; hydrocracking; catalytic cracking; hydrotreating; alkylation; polymerization and product blending. Hydrogen production; gas processing units; sulfur recovery processes; ecological considerations. Lubricating oils; solvent extraction; dewaxing. Petrochemical feedstocks; aromatics, unsaturates and saturates. Coal: combustion; gasification; liquefaction. Fischer-Tropsch synthesis; reactor technology; process flowsheets. *Independent learning section:* Students are required to investigate the SASOL Coal to Fuel Processes as a case study (Gasification and Fischer-Tropsch) during the self-study section.
Assessment: One test, one quiz, class presentation of self-study assignment, one assignment (30%); 2 h exam (70%).
DP Requirement: 80% attendance at tutorials. Completion of self-study assignment (with 50% pass).

Subminimum Requirements: The self-study presentation and the assignment must be passed as part of meeting ECSA ELO9 (independent learning ability) as the final assessment point.

Applied Reactor Technology
ENCH4RT H1   (20L-9T-0P-0S-12H-28R-0F-5G-6A-15W-8C)
Prerequisite Modules: ENCH3RT.
Aim: Understanding of complex issues in industrial installations involving approximations, economic decisions, solution for conditions in catalytic beds, the effects of heat and mass transfer limitations and the choice of reactor configurations.
Content: Thermal effects, mass transfer limitations, complex rate expressions, multiple reactions, axial/radial diffusion, and economic optimization, risk and uncertainty. Case studies based on industrial reactions (NH_3 synthesis, bioleaching of sulphide ores, Fischer-Tropsch reactors, Ziegler-Natta catalysed olefin polymerisation reactor systems). Techniques are developed for the modelling of these systems.
Assessment: one test and one open-ended assignment (15%), one computer based test (25%); 2 h exam (60%).
DP Requirement: 80% attendance at tutorials and satisfactory completion of assignment as specified in the module outline.
Subminimum Requirements: The ASPEN based simulation test must be passed as part of meeting ECSA ELO5 (engineering methods, skills and tools, including information technology). Students who do not achieve a mark of 50% or more on the ASPEN test on the first attempt will be permitted to write a make-up test. The module must be passed as part of meeting ECSA ELO2 (application of scientific and engineering knowledge), and ELO5.
The module must be passed as part of meeting ECSA ELO2 (application of scientific and engineering knowledge)

Vacation Work
ENCH4VW HC   (0L-0T-0P-0S-0H-0R-0F-0G-0A-12W-0C)
Aim: An appreciation of a realistic working environment, enabling candidates to consider their studies in context.
Content: This is a requirement for the BScEng (Chemical) degree. Vacation work is to be arranged and undertaken by students during the course of the degree in fields relevant to chemical engineering. A total of 12 weeks must be accumulated. A report on the work conducted is to be submitted to the department within one month of the conclusion of each vacation work period, together with a certificate of progress from the firm concerned, in which the actual period is also stated.
Assessment: Reports acceptable in terms of scientific method, synthesis, computer use and presentation.
DP Requirement: Satisfactory completion of vacation work reports.

Wood Pulping Technology
ENCH4WP H1   (10L-6T-0P-10S-23H-20R-8F-0G-3A-13W-8C)
Prerequisite Requirement: All first and second year modules must be completed.
Aim: To introduce candidates to wood pulping science and technology. Exposure to the relative size & importance of the industry in South Africa. To develop independent learning ability.
Content: Overview of the pulp & paper industry, the nature of wood, wood handling operations, Kraft pulping, chemical recovery in Kraft process, modifications to conventional Kraft pulping, other chemical pulping processes, mechanical pulping, bleaching, environmental issues and cleaner production in the pulping industry. Students are required to review & analyse case studies and literature on some of these components of the module.
Practicals: Kraft pulping.
Assessment: One hour test (10%), class presentation of self-study assignment (10%), written assignment (5%), laboratory prac. (5%); 2 h exam (70%).
DP Requirement: Complete assignment, and laboratory practical, satisfactorily. Completion of the self-study assignment (with a 50% pass). Attendance at the mill tour. At least 70% attendance at lectures.
The module must be passed as part of meeting ECSA ELO9 (independent learning ability) as the final assessment point.

Civil Engineering

Offered in the School of Engineering

Introduction to Civil Design

ENCV1ED H2   (10L-39T-0P-0S-27H-0R-0F-0G-4A-13W-8C)

Prerequisite Modules: ENME1DR.

Aim: To introduce students to design, of simple structures in particular, and with the emphasis on graphical methods.

Content: Graphics, analysis of beams, trusses, earthworks, structural steel & reinforced concrete, detailing, dam.

Practicals: Ballista construction.

Assessment: Class mark (40%); 4 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Engineering Practice Workshop

ENCV1EP H2   (0L-0T-0P-0S-0H-0R-0F-0G-0A-1W-0C)

Aim: Development of communication and management skills; introduction to practical aspects of engineering.

Content: One week workshop in the mid-year vacation covering basic management (including OHS, labour law, group work, management writing skills); informal graphical communications; introduction to practical aspects of civil engineering.

Practicals: Oral presentation and group project.

Assessment: Coursework comprising individual and group assignments (100%).

DP Requirement: 100% attendance.

Fluids 1

ENCV2FL H2   (20L-8T-9P-0S-28H-12R-0F-0G-3A-13W-8C)

Prerequisite Modules: MATH142, (PHYS110 or 151).

Aim: To introduce fundamental concepts of fluid dynamics/hydraulics and develop foundational knowledge and problem solving skills for subsequent modules in applied fluids engineering.

Content: Fundamental concepts relating to the characteristics of fluids: continuum formulation, viscosity, pressure. Fluid statics - the hydrostatic pressure distribution, forces on submerged surfaces, stability of floating bodies. Governing principles of fluid motion: continuity, energy and momentum conservation and simple applications. Introduction to steady flow in pipes.

Practicals: Laboratory practicals demonstrating the principles of hydrostatics, energy and momentum conservation.

Assessment: Class mark (40%); 2 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Civil Engineering Materials

ENCV2MT H1   (21L-5T-9P-0S-26H-16R-0F-0G-3A-13W-8C)

Prerequisite Modules: ENME1EM.

Aim: To introduce practical materials technology to enable understanding of the links between materials and design technologies and the behaviour and interaction of the material with its environment.

Content: Overview of stress, strain, elasticity and deformation behaviour. Introduction to timber, steels, aluminium and its alloys, concrete technology.

Practicals: Three practicals covering metals in tension, timber in bending and compression and concrete mix design and testing.

Assessment: Class mark including test(s), tutorials and practical reports (40%); 2 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Materials Workshop Course
ENCV2MW H2   (0L-0T-0P-0S-0H-0R-0F-0G-0A-1W-0C)
Prerequisite Requirement: DP for ENCV2MT.
Aim: To introduce students to the practical use of concrete and structural steel. Students will be able to design and specify concrete for special applications and erect a basic steel truss as a group project.
Content: One week Workshop in the mid-year vacation covering practical aspects of reinforced concrete and structural steel construction. Lectures and visits to construction sites.
Practicals: Assembly of steel trusses.
Assessment: 100% attendance and on successful completion of the assignments/tests, students will be awarded a certificate of proficiency.
DP Requirement: Not applicable.

Structures 1
ENCV2SA H1   (39L-9T-9P-0S-74H-20R-0F-0G-9A-13W-16C)
Prerequisite Modules: MATH141 & MATH142.
Aim: To introduce the student to elementary structural analysis and theory of strength of materials.
Content: Structural idealisation, trusses, axially loaded members, torsion, shear force and bending moment, stresses in bars and beams, analysis of stress and strain.
Practicals: Three practicals related to stress and strain.
Assessment: Class mark including test(s), tutorials and practical reports (40%); 3 h exam (60%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Structures 2
ENCV2SB H2   (39L-9T-9P-0S-74H-26R-0F-0G-3A-13W-16C)
Prerequisite Modules: ENCV2SA.
Aim: To be able to understand and use various techniques to determine deformation of structures, analyse three-pinned arches and suspension cables, understand the concepts of influence lines (IL) and determine IL of structural systems, analyse columns of different types, understand the concept of torsion in structures.
Content: Column buckling, deflection of beams, energy methods, influence lines, three-pinned arches, suspension cables, two-dimensional frames.
Practicals: Buckling tests and making of a truss and a tower out of sheet metal or numerical simulation of frames.
Assessment: Tests (40%); 3 h exam (60%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Structural Design 1
ENCV2SD H2   (42L-10T-0P-0S-49H-48R-6F-0G-5A-13W-16C)
Prerequisite Modules: ENCV2SA.
Aim: To provide students with the limit state concepts in structural design and how they are applied in basic reinforced concrete and structural steel design.
Content: Structural design limit states, loads and material factors. Reinforced concrete concepts and design of beams for bending, shear, torsion and deflection. Structural steelwork design of connections, ties, struts and beams.
Practicals: Assignment relating to rc beams and steel.
Assessment: Class mark (40%); 3 h exam (60%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Civil CADD Workshop
ENCV3CW H2   (0L-0T-0P-0S-0H-0R-0F-0G-0A-1W-0C)
Prerequisite Requirement: DP for ENCV3ST.

Prerequisite Modules: ENCV2SD.

Aim: To develop a basic proficiency in CAD.

Content: One week Workshop in the mid-year vacation where candidates are introduced to software packages for design and drawing and will prepare a typical example project.

Assessment: 100% attendance and on successful completion of the assignments, students will be awarded a certificate of proficiency.

DP Requirement: Not applicable.

Fluids 2

ENCV3FA H1   (40L-24T-16P-0S-51H-24R-0F-0G-5A-13W-16C)

Prerequisite Modules: ENCV2FL.

Aim: Develop the fundamental theory & applications of fluid dynamics/hydraulics in civil & environmental engineering.

Content: Physical similarity and dimensional analysis. Steady flow in pipes – series, parallel & branched. Pipe distribution networks. Pumping systems. Unsteady effects in pipelines. Boundary layer theory & applications (separation; skin-friction & form drag); Potential flows. Other selected topics such as groundwater, water waves.

Practicals: 3 lab experiments demonstrating the fundamental principles of fluid flow systems e.g. energetics, boundary layers and separation.

Assessment: Class mark (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Fluids 3

ENCV3FB H2   (39L-10T-9P-0S-77H-20R-0F-0G-5A-13W-16C)

Prerequisite Requirement: 40% in STAT370.

Prerequisite Modules: ENCV2FL.

Aim: Develop the fundamental theory & applications of fluid dynamics/hydraulics in civil & environmental engineering.

Content: Fundamentals of open channel flows (steady uniform/non-uniform, unsteady). Hydrology for water resources management, and flood hydrology. Reservoir and channel routing. Dams & hydraulic structures (weirs, flumes, spillways, culverts, etc.). River & canal engineering. Other selected topics & applications such as sediment transport, water waves & coastal engineering.

Practicals: 3 lab experiments demonstrating the fundamental principles of open channel hydraulics e.g. energetics, hydraulic jumps, flood routing, weirs, etc.

Assessment: Class mark (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Geotechnical Engineering Studies 1

ENCV3G1 H1   (40L-9T-9P-0S-73H-24R-0F-0G-5A-13W-16C)

Aim: To introduce the fundamental concepts of Geotechnical Engineering with reference to basic characteristics & physical properties of the soils. Soils behaviour in presence of static & dynamic water. Foundational knowledge for geotechnical engineering.

Content: Introduction to Soil Mechanics, origin & composition of soils, soil classification, basic physical properties of soils, description of soils, water in soils, introduction to stresses in soils (total, effective & pore water stresses). Compaction tests, methods & interpretation of test results. Soil as a foundation for structures and as a material of construction. Stress distribution in soil.

Practicals: Execution and analysis of soils laboratory tests.

Assessment: Test and practical reports (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Geotechnical Engineering Studies 2

ENCV3G2 H2 (40L-9T-9P-0S-73H-24R-0F-0G-5A-13W-16C)

Prerequisite Modules: ENCV3G1.

Aim: To provide basic information and skills in geotechnical investigations, in the analysis of physical and geotechnical properties of soils in relation to the stability of slopes and in the estimation of settlement of structures on sands and clays.

Content: Bearing capacity and settlement of shallow and deep foundations. Analysis of settlement of engineering works, on sands and consolidation settlement of clays. Fundamentals of Mohr Coulomb shear strength for soils, shear box tests and frictional model. Drained and undrained shear strength analysis and triaxial tests. Slope stability. Geotechnical investigations, sampling techniques and determination of soil parameters.

Practicals: Execution of appropriate laboratory tests and submission of lab reports and geotechnical investigation assignment.

Assessment: Test(s), assignment, and practical report (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Mathematical Systems

ENCV3MS H2 (20L-17T-0P-0S-26H-12R-0F-0G-5A-13W-8C)

Prerequisite Modules: MATH238, 248, STAT370.

Aim: To develop skills in the formulation and numerical solution (primarily using spreadsheet software) of simple mathematical models.

Content: Systems conceptualisation, Mathematical modelling and numerical techniques. Curve and surface fitting to discrete data by least squares. Numerical integration and differentiation. Numerical optimization - applications in production, transportation and construction. Finite difference solutions of Laplace, Poisson, heat and wave equations - applications to fluid flows, torsion, heat flow.

Practicals: Computer laboratory practice in the application of spreadsheets in advanced mathematical modelling and numerical solution.

Assessment: Class mark (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Structural Design 2

ENCV3SD H2 (42L-10T-0P-0S-44H-48R-6F-0G-10A-13W-16C)

Prerequisite Modules: ENCV2SD, ENCV3ST.

Aim: To introduce students to further applications of reinforced concrete and structural steel design not previously considered in second year.

Content: Theoretical treatment and interpretation of structural codes and models is extended. Topics include concrete flooring systems, *in situ* beam/slab systems, flat slabs, concrete columns under bending, concrete foundation systems, reinforced concrete and steel framed buildings, behaviour of and design of plate girders, monosymmetric and class 4 beams, steel columns with bending, frames, steel beam to column connections (including prying action), base connections, lattice girders and trusses. Introduction to bracing systems and wind loading. Plastic design of beams.

Practicals: Mini design project involving reinforced concrete and steel.

Assessment: Test(s), tutorials and project (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Structures 3

ENCV3ST H1 (40L-20T-18P-0S-50H-26R-0F-0G-6A-13W-16C)

Prerequisite Modules: ENCV2SA, ENCV2SB.

Aim: To introduce the compatibility and equilibrium methods of analysing indeterminate structures.

Content: Analysis of indeterminate structures by compatibility (strain energy, virtual work, moment area) and equilibrium methods: slope deflection, moment distribution, matrix methods. Symmetry, skew-symmetry, closed structures. Arches. Influence lines of indeterminate structures. Model analysis Approximate methods of analysis. Introduction to finite elements. Computer applications.

Practicals: Assignment involving use of computer software for structural analysis.

Assessment: Class mark (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Transport 2
ENCV3TP H2   (20L-5T-9P-0S-27H-16R-0F-0G-3A-13W-8C)

Prerequisite Modules: ENCV3G1, ENCV3TT, GEOL215.

Aim: Introduce examples of design processes used in transportation networks and systems and prepare the students for later evaluation and design of such systems.

Content: Design of elements of road transportation system, such as road pavements, parking layouts, earthworks and materials.

Practicals: Bituminous material properties and grading, design of asphalt mixes and surface seals.

Assessment: Class mark (40%); 2 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Transport 1
ENCV3TT H1   (39L-10T-0P-0S-68H-38R-0F-0G-5A-13W-16C)

Prerequisite Requirement: Must be in third year of study.

Aim: Develop students' appreciation and understanding of the fundamentals of the evolution of transportation systems. Expand on this knowledge, appreciation and understanding of the underlying theory and principles of transport – particularly in so far as these relate to the design of basic transportation system.

Content: Introduction to highway and transportation engineering leading to traffic engineering.

Assessment: Class mark (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Civil Engineering Design Project
ENCV4DE H2   (0L-0T-0P-0S-236H-0R-0F-0G-4A-13W-24C)

Prerequisite Requirement: Has passed all preceding core modules in the program.

Aim: To independently research a relevant Civil Engineering issue and produce a professionally presented portfolio.

Content: Investigation into a field of Civil Engineering involving a literature survey, conceptual and detailed computation and design in varying proportions, summarised in a professionally presented manner in a report with design calculations and construction drawings. Typical topics could include the following: An industrial site development, buildings, roads, parking and retaining walls. A freeway interchange with adjoining roads. A dam and ancillary works.

Assessment: Based on a detailed design report (including drawings), and an oral examination. Module divided into two portions: group work (25%) and individual portion (75%). A pass mark for the individual portion is required as a subminimum. Students are required to show competence in each ECSA outcome relevant to this module as specified in the module documents.

DP Requirement: Not applicable.

No supplementary examination is allowed, but in marginal cases the examiners may allow a 1-week upgrade process to address minor deficiencies. If such an upgrade is successful, a passing grade of 50% will be awarded.

Dissertation
ENCV4DS H2   (0L-0T-0P-0S-236H-0R-0F-0G-4A-13W-24C)

Prerequisite Requirement: Has passed all preceding core modules in the program.

Aim: The candidate will be able to independently research a Civil Engineering issue and present their findings. To develop and consolidate research & reporting skills.

Content: Investigation into a field of Civil Engineering involving a literature survey, experimentation, and computation in varying proportions, summarised in a professionally presented research document. Typical topics could include the following: Hydrological investigations such as reservoir reliability. Transportation investigations such as secondary trips to shopping centres. Labour intensive construction methods.

Assessment: Dissertation (70%), oral presentation/examination (30%). Students are required to show competence in each ECSA outcome relevant to this module as specified in the module documents.

DP Requirement: Satisfactory completion of a research proposal and a preliminary literature review in the initial stages of the project.

No supplementary examination is allowed, but in marginal cases the examiners may allow a 1-week upgrade process to address minor deficiencies. If such an upgrade is successful, a passing grade of 50% will be awarded.

Ground and Structural Engineering
ENCV4GS H1   (39L-18T-0P-0S-51H-40R-7F-0G-5A-13W-16C)

Prerequisite Modules: ENCV3G1, ENCV3G2, ENCV3SD & ENCV3ST.

Aim: To introduce advanced concepts and techniques in Geotechnical Engineering and Structures in a context where there is interdependence of one on the other, using a major project.

Content: Bearing capacity analysis, Limit State Design using partial factors, retaining structures, prestressed concrete, selected advanced structures topics such as yield line analysis, plastic analysis of frames.

Assessment: Tests, assignments and tutorials: (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Transport and Environmental Management
ENCV4TE H1   (39L-11T-0P-0S-72H-32R-2F-0G-4A-13W-16C)

Prerequisite Modules: ENCV3TT.

Aim: To introduce basic principles of management and planning, which are integrated into practical examples in environmental management and transport networks.

Content: Introduction to the basic management and ecological cycles as well as the social, financial, and legal environments into which the technical concepts of civil engineering are integrated. Applications in the natural and built environment in conformance with the world conservation strategy and more detailed study of the management, and planning of transport systems to fulfil all requirements.

Assessment: Assignment (40%); Two 2 h exams (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Vacation Work
ENCV4VW HC   (0L-0T-0P-0S-0H-0R-0F-0G-0A-12W-0C)

Aim: An appreciation of a realistic working environment, enabling candidates to consider their studies in context.

Content: This is a requirement for the BScEng (Civil) degree. Vacation work is to be arranged and undertaken by students during the course of the degree in fields relevant to chemical engineering. A total of 12 weeks must be accumulated. A report on the work conducted is to be submitted to the department within one month of the conclusion of each vacation work period, together with a certificate of progress from the firm concerned, in which the actual period is also stated.

Assessment: Reports acceptable in terms of scientific method, synthesis, computer use and presentation.

DP Requirement: Satisfactory completion of vacation work reports.

Water and Environmental Engineering

ENCV4WE H1   (39L-10T-0P-0S-86H-20R-0F-0G-5A-13W-16C)

Prerequisite Modules: ENCV2FL, ENCV3FA, ENCV3FB.

Aim: The module will introduce the students to the fundamentals of water and environmental engineering, with particular focus on control, management and treatment of polluting emissions into the environment. Basic hydrological concepts will find a practical application in the assessment of pollution dispersion mechanisms in water systems, design of wastewater treatment systems (municipal wastewater, landfill leachate and mine effluents) and solid waste management.

Content: Fundamentals of environmental engineering and water resources management (quality and quantity), qualitative characterisation of wastewaters (domestic and industrial), pollution dispersion in water systems, basic design and management of potable and waste water treatment plants, introduction to solid waste management; groundwater pollution engineering.

Assessment: Class mark (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Environmental Impact Assessment

ENCV8EI H1   (20L-10T-0P-0S-30H-10R-0F-0G-10A-15W-8C)

Pre-requisite requirement: BScEng and BScHons with more than 55% - exit level: MSc(Eng) BScEng and BScHons with less 55% - admittance granted by the School via Rule GR7B BTech – admittance granted by the School via Rule GR7B.

Co-requisite modules: ENCV8RM; ENCV8MS; ENCV8WR; ENCV8ES

Aim: The module will aim at exploring interactions between human activities and natural or man-made systems, focusing on resource and waste management and linking them to the concept of environmental sustainability and to the EIA procedures. It includes an overview of sustainable development and EIA, EIA as an implementation tool for sustainability, EIA procedures and institutional setting in South Africa, the different phases and types of an EIA process, public participation, strategic environmental impact assessment, international perspectives and the use of EIAs in developing countries.

Content: The module deals with the current environmental impact assessment (EIA) regulations in South Africa in great detail. These regulations are the main decision making tools with regard to managing environmental impacts. They apply to the waste management industry and need to be observed before any development proceeds in this field. In particular the establishment of landfill sites and any other large waste projects (e.g. transfer stations, recycling facilities, anaerobic digesters, etc.) for waste management needs a prior EIA. The students will achieve advanced knowledge of the EIA rationale and process in this country, including the history of this tool, steps involved linkages with the existing permitting system and a comparison with the application in other countries. In terms of skills outcomes the students will be able to conduct a simplified EIA in one of the areas of waste and resource management. The knowledge and the skills provided entrench this module as a supporting framework/tool for other modules in the programme.

Practicals: None.

Assessment: 30% Formative method for the class mark, which will be made up of tutorials (5%) and an assignment (simplified EIA) (25%) and 70 % summative method for the exam mark. The exam is 2 hours.

DP Requirement: None

Environmental Sanitary Engineering

ENCV8ES H1   (40L-0T-0P-5S-60H-12R-0F-20G-20A-15W-16C)

Pre-requisite requirement: BScEng and BScHons with more than 55% - exit level: MSc(Eng) BScEng and BScHons with less 55% - admittance granted by the School via Rule GR7B BTech – admittance granted by the School via Rule GR7B.

Co-requisite modules: ENCV8RM; ENCV8MS; ENCV8WR; ENCV8EI

Aim: The main aim of this module is to prepare students to acquire knowledge on fundamentals of environmental sanitary engineering and solid/liquid waste management. The students will achieve an appreciation of the extent of the

problem related to environmental pollution, and most of all, they will receive the tools to design and manage appropriate treatment/disposal facilities.

Content: This course will give to the students an overview of the basic characteristics of polluted and potable effluents; dynamics of contamination of water systems; the fundamentals in the design and management of wastewater/leachate treatment plants; the fundamentals of solid waste management and emissions control.

Practicals: None.

Assessment: Class mark: 30% Assignment; Final exam: 70%.

DP Requirement: None

Management of Industrial Waste

ENCV8IW H2   (20L-10T-0P-0S-20H-6R-0F-0G-24A-15W-8C)

Pre-requisite requirement: BScEng and BScHons with more than 55% - exit level: MSc(Eng) BScEng and BScHons with less 55% - admittance granted by the School via Rule GR7B BTech – admittance granted by the School via Rule GR7B.

Co-requisite modules: ENCV8RM; ENCV8MS; ENCV8WR; ENCV8EI; ENCV8ES

Aim: The main aim of this module is to prepare students to analyse and develop/design industrial waste management strategies by acquiring a basic understanding of typical industrial wastes and both traditional and innovative management and treatment strategies.

Content: Students completing the module will be able to identify appropriate industrial waste management and treatment strategies based on the properties of waste materials; develop/design integrated industrial waste management strategies that incorporate reuse, recycle, reduction, treatment, and disposal; apply waste management tools and metrics to industrial processes; and work collaboratively to solve a particular industrial process/ waste management challenge.

Practicals: None.

Assessment: Class mark – 30% made of: Case study review - paper and presentation 10%, Project 20%, Examination 70%.

DP Requirement: None

Landfill Design and Management

ENCV8LD H2   (30L-0T-0P-0S-47H-10R-0F-20G-50A-15W-16C)

Pre-requisite requirement: BScEng and BScHons with more than 55% - exit level: MSc(Eng) BScEng and BScHons with less 55% - admittance granted by the School via Rule GR7B BTech – admittance granted by the School via Rule GR7B.

Co-requisite modules: ENCV8RM; ENCV8MS; ENCV8WR; ENCV8EI, ENCV8ES

Aim: The main aim of this module is to prepare students to develop landfill design and management strategies and to integrate landfilling into the overall solid waste management concept by acquiring a basic understanding of the biological, chemical and physical processes in the landfill, the processes for the treatment and utilization of landfill gas and the leachate treatment processes as well as the effect of potential emissions on the environment.

Content: Students completing the module will be able to site and design a landfill and to describe the operation in order to minimize emissions. Specific aspects are liner selection and performance as well as drainage systems, re-cultivation of closed landfills and emission control monitoring. Landfill gas modelling as well as landfill gas extraction and utilization strategies will be presented and discussed as well as the different leachate treatment options. Different concepts and scenarios will be presented and validated. An overall environmental assessment of the landfill management is an important subject of this module. Public perception and cost minimization are introduced.

Practicals: None.

Assessment: Class mark 30% made of: Case study review (made of a short paper and a presentation) 10% Project 20% Examination 70%.

DP Requirement: None

Integrated Waste Management Systems

ENCV8MS H1   (40L-0T-0P-5S-60H-12R-0F-20G-20A-15W-16C)

Pre-requisite requirement: BScEng and BScHons with more than 55% - exit level: MSc(Eng) BScEng and BScHons with less 55% - admittance granted by the School via Rule GR7B BTech – admittance granted by the School via Rule GR7B.

Co-requisite modules: ENCV8RM; ENCV8WR; ENCV8ES, ENCV8EI

Aim: The objective of this module is to provide the student with an overview of managing waste from cradle-cradle through the implementation of integrated waste management systems (collection, separation, reuse, recycling, recovery, treatment and disposal).

Content: Basic components of an integrated waste management system. Systematic approach to implementing integrated waste management systems in municipalities. Financial and technological considerations to implementing IWM solutions. Scenario analysis for municipalities.

Practicals: None.

Assessment: Class mark: 30% Assignment; Final exam: 70%.

DP Requirement: None

Management of Organic Waste

ENCV8OW H2   (20L-0T-0P-0S-20H-6R-0F-10G-24A-15W-8C)

Pre-requisite requirement: BScEng and BScHons with more than 55% - exit level: MSc(Eng) BScEng and BScHons with less 55% - admittance granted by the School via Rule GR7B BTech – admittance granted by the School via Rule GR7B.

Co-requisite modules: ENCV8RM; ENCV8WR; ENCV8MS; ENCV8ES, ENCV8EI

Aim: The aim of this module is to give technology solutions for organic waste management and to provide specialist understanding of resource recovery technologies as energy production and/or alternative valuable products.

Content: Overview of biological processes used for the management of organic waste of different derivation (industrial, agricultural and domestic) with strong emphasis to anaerobic digestion process and composting process.

Practicals: None.

Assessment: Class mark: 30% Assignment; Final exam: 70%.

DP Requirement: None

Dissertation

ENCV8RD HY   (0L-0T-0P-0S-960H-0R-0F-0G-0A-30W-96C)

Aim: This research component of the CW Master is necessary in order to provide the country with a cadre of researchers in Engineering who are able to provide strategic and evidence informed guidance and contribute in a scholarly way in addressing local, regional and global Engineering-related issues specific to the discipline (Waste and Resources Management). The students should contribute in generating and/or broadening the knowledge base in the selected area of study and influence engineering related policies and practices. This module will enable students to develop and become effective and skilled researchers in Engineering, equipped to become research orientated in their on-going professional development. The overall degree will equip the candidate with the knowledge and the skills necessary either for employment in Engineering (including teaching and research positions) or for further independent research towards the degree of PhD.

Content: This module aims to prepare independent researchers in Engineering who can contribute to the generation of knowledge at an advanced level by conducting original research that addresses complex context based issues, under the guidance of the research supervisor. The research project will culminate in the production of a research report in the form of a dissertation in the traditional format or by publication. The programme aims to provide graduates with specialized knowledge and competence in Engineering (Waste Management, and Environmental Engineering in particular) who can contribute to the field and national priorities for growth and development in the various disciplines of Engineering.

Assessment: The achievement of learning outcomes will be assessed through a thesis/dissertation in the traditional format or by publications that will be submitted for examination on completion of the research project. All reports from examiners will be analysed on completion by the Programme Coordinator and School Research Academic Leader, and the final report with recommendations on how to improve will be disseminated to all academic staff members involved in the supervision and marking of research projects in this programme.

DP Requirement: Successfully complete ENCV8RM Research Methodology in Waste Management.

Dissertation Subsequent Yr
ENCV8RD H1 H2   (0L-0T-0P-0S-960H-0R-0F-0G-0A-30W-96C)

Research Methodology in Waste Management
ENCV8RM H1   (40L-10T-0P-0S-50H-16R-0F-0G-44A-15W-16C)
Pre-requisite requirement: BScEng and BScHons with more than 55% - exit level: MSc(Eng) BScEng and BScHons with less 55% - admittance granted by the School via Rule GR7B BTech – admittance granted by the School via Rule GR7B.
Co-requisite modules: ENCV8MS; ENCV8WR; ENCV8ES; ENCV8EI
Aim: The main aim of this module is to offer advanced knowledge in Research Methodology as related to Waste and Resources Management. This entails a thorough understanding of research proposals, literature review, conceptualization of research, research tools, data collection and analysis, modelling and simulation, design and construction of treatment solutions/systems, measurements and writing skills, and plagiarism, principles of research report writing and dissemination, as well as plagiarism. Students will acquire theoretical foundation of research methodology, which will support them in their own independent research projects and in particular in the Dissertation component of this Programme.
Content: The aim of this module is to introduce the student to advanced research skills. Themes include: starting the dissertation, planning the research project and formulating research questions, structuring of enquiry and the ethics or politics of research, literature reviews, nature of quantitative and qualitative research, methodology, data analysis and modelling, structured conclusions.
Practicals: None.
Assessment: Class mark – 30% made of individual or group assignments or tests Examination 70%.
DP Requirement: None.

Waste Management Logistics
ENCV8WL H2   (20L-10T-0P-0S-20H-6R-0F-0G-24A-15W-8C)
Pre-requisite requirement: BScEng and BScHons with more than 55% - exit level: MSc(Eng) BScEng and BScHons with less 55% - admittance granted by the School via Rule GR7B BTech – admittance granted by the School via Rule GR7B.
Co-requisite modules: ENCV8RM; ENCV8MS; ENCV8WR; ENCV8ES; ENCV8EI
Aim: The main aim of this module is to prepare students to acquire knowledge in integrated waste management strategies that are focussed on approaches and technologies that ensure efficient collection, transportation, treatment of waste from source to material recovery and disposal sites.
Content: Overview of solid waste generation, on-site handling, storage and processing, collection services, types of collection systems, determination of collection routes, along with vehicle and labour requirements; transfer stations and their location, transfer means and methods and disposal of solid waste. Reverse logistics.
Practicals: None.
Assessment: Class mark: 30% Assignment; Final exam: 70%.
DP Requirement: None

Waste Management in Developing Countries
ENCV8WM H2   (20L-10T-0P-0S-20H-6R-0F-0G-24A-15W-8C)
Pre-requisite requirement: BScEng and BScHons with more than 55% - exit level: MSc(Eng) BScEng and BScHons with less 55% - admittance granted by the School via Rule GR7B BTech – admittance granted by the School via Rule GR7B.
Co-requisite modules: ENCV8RM; ENCV8MS; ENCV8WR; ENCV8ES; ENCV8EI
Aim: The main aim of this module is to prepare students to acquire knowledge in integrated waste management strategies that are focussed on approaches and technologies that ensure efficient collection, transportation, treatment of waste from source to material recovery and disposal sites.
Content: Overview of solid waste generation, on-site handling, storage and processing, collection services, types of collection systems, determination of collection routes, along with vehicle and labour requirements; transfer stations and their location, transfer means and methods and disposal of solid waste. Reverse logistics.

Practicals: None.
Assessment: Class mark: 30% Assignment; Final exam: 70%.
DP Requirement: None

Management of Waste as a Resource

ENCV8WR H1 (40L-0T-0P-5S-600H-12R-0F-00G-20A-15W-16C)
Pre-requisite requirement: BScEng and BScHons with more than 55% - exit level: MSc(Eng) BScEng and BScHons with less 55% - admittance granted by the School via Rule GR7B BTech – admittance granted by the School via Rule GR7B.
Co-requisite modules: ENCV8RM; ENCV8MS; ENCV8ES; ENCV8EI
Aim: The main aim of this module is to prepare students to acquire knowledge in waste management strategies that are focussed on approaches and technologies that ensure maximum value recovery from waste through materials recycling and energy production.
Content: Overview of biological, physical-chemical and thermal treatment technologies supporting reuse, recycling and resource/energy recovery of waste. Development and implementation of decision-making tools to select sustainable waste management scenarios and strategies for the management and valorisation of waste as a resource.
Practicals: None.
Assessment: Class mark: 30% Assignment; Final exam: 70%.
DP Requirement: None

Design of Water/Wastewater Treatment Plnts

ENCV8WT H2 (40L-20T-4P-0S-40H-12R-0F-0G-44A-15W-16C)
Pre-requisite requirement: BScEng and BScHons with more than 55% - exit level: MSc(Eng) BScEng and BScHons with less 55% - admittance granted by the School via Rule GR7B BTech – admittance granted by the School via Rule GR7B.
Co-requisite modules: ENCV8RM; ENCV8MS; ENCV8WR; ENCV8ES; ENCV8EI
Aim: The main aim of this module is to prepare students to understand of the principles for designing and managing wastewater and potable water treatment plants.
Content: Students completing the module will be able to design components of water and wastewater treatment facilities; and to evaluate appropriate treatment options on the basis of final water quality objectives, regulatory requirements, economics, and available resources.
Practicals: Students will visit at least one potable water or wastewater treatment plant.
Assessment: Class mark – 30% made of: Design Problems (5 per semester) 25% Quizzes 5% Examination 70%.
DP Requirement: None

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Electrical, Electronic & Computer Engineering

Offered in the School of Engineering

Electrical Design 1

ENEL1ED H2 (20L-5T-5P-0S-31H-15R-0F-0G-4A-13W-8C)
Aim: To be able to: Make an oral presentation on technical subject matter. Analyse and synthesize formal problem definitions. Synthesize and present structured and documented solutions incorporating Pseudo-code, Flow diagrams, Matlab code. Deploy such solutions in Matlab or build physical models/prototypes where required. Appreciate and incorporate basic design methodology.
Content: Philosophy of design. Introduction to Matlab. Communication skills. Engineering theory, practical design and assignment.
Practicals: Project design of an electrical/electronic instrument.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: Performed all practicals and assignments satisfactorily, as specified in the module outline.

Computer Methods 1

ENEL2CA H1   (20L-10T-10P-0S-26H-10R-0F-0G-4A-13W-8C)

Prerequisite Modules: ENEL1ED.

Aim: To Introduce the basic concepts of writing procedural code with sequence, selection and repetition. The representation of data in arrays, passing of data and storage in files. Presentation of structured and documented solutions to selected data processing problems.

Content: Procedures, selection and looping control structures, basic data representation and file access, algorithms, programs and computers.

Practicals: Programming assignments covering major aspects of the module content.

Assessment: Coursework and tests (30%); 2 h exam (70%).

DP Requirement: Performed all laboratory practicals or equivalent assignments satisfactorily, as specified in the module outline.

Computer Methods 2

ENEL2CB H2   (20L-10T-10P-0S-26H-10R-0F-0G-4A-13W-8C)

Prerequisite Modules: ENEL2CA.

Aim: To extend the computer programming paradigms presented in ENEL2CA: Programming for graphical user interfaces; event driven programming; Object oriented programming and application frameworks. These four concepts will be illustrated with a suitable programming language and application development system/framework to instil a good grasp of these concepts and how they are applied to large software projects to enhance productivity and reliability through good code encapsulation, documentation and re-use.

Content: The chosen language syntax; coding for the event driven paradigm; the concepts and tenets of Object Oriented Programming; an introduction to application frameworks and the use of one typical framework; developing a system using all these paradigms.

Practicals: Programming Assignments covering major aspects of the course content.

Assessment: Coursework and tests (30%); 2 h exam (70%).

DP Requirement: Performed all laboratory practicals or equivalent assignments satisfactorily, as specified in the module outline.

Applied Computer Methods

ENEL2CM H1   (20L-10T-10P-0S-26H-10R-0F-0G-4A-13W-8C)

Aim: To provide an introduction into using software based solutions to solve engineering problems. Analysis, representation and manipulation of data. Analysis and representation of selected data processing problems. The structured top-down, algorithmic approach to solving engineering problems. Using Matlab as a medium for the deployment of software solutions; data processing and presentation; system analysis and high level mathematical computation.

Content: Programs and computers. Matrices and data structures. Data analysis, presentation and manipulation. Matlab programming. Program Design, debugging and verification. Solution to numerical and non-numerical mathematical problems. Matlab applications for Chemical Engineering.

Practicals: Practical work to exercise knowledge.

Assessment: Coursework and tests (30%); 2 h exam (70%).

DP Requirement: Performed all laboratory practicals or equivalent assignments satisfactorily, as specified in the module outline

Data Structures & Algorithms

ENEL2DS H2   (20L-10T-10P-0S-26H-10R-0F-0G-4A-13W-8C)

Aim: To provide an understanding of data structures and algorithms used in computers.

Content: Survey of data structures. Arrays: stacks & queues, linked list, trees, graphs, symbol tables, files. Introduction to algorithmic complexity. Selection of algorithms from: sorting, searching, numerical and string processing.

Assessment: Coursework and tests (30%); 2 h exam (70%).

DP Requirement: Performed all laboratory practicals or equivalent assignments satisfactorily, as specified in the module outline.

Electrical Principles 1
ENEL2EA H1   (39L-11T-12P-0S-74H-18R-0F-0G-6A-13W-16C)
Prerequisite Modules: (PHYS152 or PHYS120), MATH132, MATH141.
Aim: To provide the necessary background to enable students to solve simple electrical circuits using circuit theorems and analysis techniques and apply the theory of magnetic fields to the analysis of fundamental electrical devices.
Content: Ideal linear circuit elements. Mesh and nodal analysis and network theorems. Application of phasors to the analysis of AC circuits. Transient response of simple circuits. Average and RMS. Impedance, admittance and power in AC circuits. Introduction to three-phase circuits and frequency response. Magnetic field produced by current carrying wires. Equivalent circuit model of the transformer and DC machine. Introduction to the induction motor.
Practicals: Four 3-hr laboratory practicals.
Assessment: Class mark (30%); 3 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Electrical Principles 2
ENEL2EB H2   (39L-11T-12P-0S-74H-18R-0F-0G-6A-13W-16C)
Prerequisite Modules: ENEL2EA.
Aim: To provide an introduction to electronic systems, analogue and digital electronics and measurement principles. To provide practical reinforcement of the theoretical material through laboratory sessions.
Content: Electronic systems: block diagram description of analogue and digital systems. Sinusoidal & periodic signals: frequency response, Bode plot and the decibel. Outline of Fourier analysis. Analogue building blocks: The ideal operational amplifier, linear and non-linear circuits and their applications. Practical operational amplifiers and their limitations. Differential amplifiers and common-mode rejection. Diodes, transistors, bias circuits and their applications in simple circuits. BJT amplifier circuits: load lines. Small-signal models and analysis of amplifier circuits in the three basic configurations. Digital building blocks: digital information, binary number system, base conversions, binary addition and subtraction, sign-magnitude representation and binary codes. Combinational logic, truth tables, combinational gates, gate implementation, steady state and dynamic behaviour of CMOS gates, physical representation of binary states, logic families, Boolean algebra, logic minimisation including QM, applying MSI devices. Introduction to sequential logic, latches, flip flops, counters and registers, timers and oscillators. Digital systems: introduction to A/D and D/A conversion.
Measurement principles: precision and accuracy, resolution and range.
Assessment: Class mark (30%); 3 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.
Subminimum Requirements: Subminimum of 40% in the Analogue section and 40% in the Digital section of the examination.

Electronic Engineering
ENEL2EC H2   (20L-5T-6P-0S-32H-11R-0F-0G-6A-13W-8C)
Prerequisite Modules: ENEL2EL.
Aim: To understand the frequency spectra of some periodic and non-periodic signals. Analyse and test the performance of some simple analogue and digital circuits.
Content: Signals and waveforms. Frequency response of simple filter circuits, the decibel and Bode plots. Amplifiers, the operational amplifier and their use in various linear circuits. Diode and transistor characteristics and their applications in simple analogue and digital circuits. Digital information. Combinational logic circuits, logic gates and logic families.
Sequential logic circuits, flip flops, registers, latches and counters. A/D and D/A conversion techniques.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Electrical Design 2
ENEL2ED H2   (15L-10T-15P-0S-26H-10R-0F-0G-4A-13W-8C)
Prerequisite Modules: ENEL1ED.
Corequisite: ENEL2EB.
Aim: To introduce electrical instrumentation and measurement techniques, the use of transducers in measurement and the principles of electrical and electronic design.
Content: Instrumentation: standards and definitions (units, absolute and relative measurement, instrument range, accuracy, linearity, calibration and traceability). Electrical measurements: deflecting instruments, measurement of AC and DC voltages and currents, measurement of resistance, inductance and capacitance, use of digital and analogue oscilloscopes (bandwidth, triggering modes, loading). Linear least squares curve fitting for linear parameter models. Transducers including bridge based sensors. Elementary error analysis. Instrumentation amplifiers: noise, grounding and shielding. Electronic design: lectures and tutorial assignments on aspects of electronic engineering design. Design exercises will be performed by groups of students. Magnetic circuit design: Design, construction and testing of a nonlinear magnetic circuit device.
Practicals: Practical design of electrical/electronic devices.
Assessment: Self-study report, design, laboratory report (30%); 2 h exam (70%).
DP Requirement: Performed all assignments satisfactorily, as specified in the module outline.

Electrical & Electronic Engineering
ENEL2EE H1   (39L-10T-12P-0S-68H-24R-0F-0G-7A-13W-16C)
Prerequisite Modules: (PHYS120, 152 or 162), MATH132, MATH141.
Aim: To introduce electrical and electronic engineering fundamental principles and their applications to Chemical Engineering students.
Content: Ideal circuit elements: voltage and current sources, resistance, capacitance, network theorems, transient response, average and rms values, frequency response. Phasor methods, impedance and admittance, active and reactive power. AC circuit theorems, single and three phase power circuits, transformers, electrical machines including induction motors. Semiconductor devices: Ideal and pn diode, rectifiers. Bipolar junction transistor (BJT) characteristics, switching circuits and small-signal amplifiers. Logic gates, combinational systems, sequential systems consisting of latches, registers, shift registers and counters. Frequency spectra, RC filters, Bode diagrams. Operational amplifiers as amplifiers and comparators. Use of oscilloscope and multimeter, measurement techniques.
Assessment: Class mark (30%); 3 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Electrical Engineering
ENEL2EL H1   (39L-10T-12P-0S-68H-24R-0F-0G-7A-13W-16C)
Prerequisite Modules: (PHYS120 or 152), MATH132, MATH141.
Aim: To Introduce Electrical Engineering fundamental principles and their applications to Mechanical Engineering students.
Content: Ideal linear circuit elements; mesh and nodal analysis of resistive networks; network theorems; transient response of simple circuits; average and RMS; alternating current and phasor methods; DC machines; single phase transformers; transmission and distribution of electrical power; industrial application of machines.
Assessment: Class mark (30%); 3 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Environmental Engineering
ENEL2EN H2   (20L-5T-0P-0S-40H-10R-0F-0G-5A-13W-8C)
Aim: Students will cultivate an appreciation for the environment, will know environmental legislation, how to implement appropriate environmental management strategies and environmental impact assessments and be aware of ISO standards and of how to implement them.
Content: Environmental awareness; environmental issues; integrated environmental management; legislation and regulations; environmental parameters; environmental cost; environmental impact assessment (EIA); monitoring of the

environment; management plans; ISO standards. Impact of engineering activity and technology on society and the physical environment. Occupational and public health and safety.
Assessment: Tests (25%); 2 h exam (75%).
DP Requirement: None
Subminimum Requirement: The assignment must be passed as part of meeting ECSA ELO7 (Sustainability and impact of engineering activity: on the natural environment).

Field Theory
ENEL2FT H2 (20L-5T-6P-0S-30H-14R-0F-0G-5A-13W-8C)
Prerequisite Modules: (PHYS120 or 152), MATH238.
Corequisite: MATH248.
Aim: To introduce basic concepts to enable students to solve static electric and magnetic field problems and understand how force and charge cause these fields.
Content: Electrostatics: conservation of charge, Coulomb's law, electric field intensity, Kirchhoff's laws, power and energy relationships, Gauss's theorem, divergence theorem, capacitance, energy stored. Electromagnetics: forces between moving charges, magnetic field, forces between current elements, Biot-Savart law, Ampere's circuital law, Lorentz's equation, generated and induced emf, Faraday's laws, Maxwell's equations.
Assessment: Coursework and tests (30%); 2 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Nuclear & Semiconductor Physics
ENEL2NP H2 (20L-5T-18P-0S-20H-12R-0F-0G-5A-13W-8C)
Prerequisite Modules: PHYS120 or 152.
Aim: Knowledge and understanding of, and an ability to apply nuclear physics and semiconductor physics appropriate for Electrical Engineering students.
Content: Nuclear Physics (13L): atomic structure, wave nature of particles, introduction to quantum mechanics, nuclear structure, radioactivity, nuclear reactions, reactors, biological effects of radiation, safety and environmental issues. Semiconductor Physics (13L): energy band theory, semiconductors, doping, charge carriers, pn junction, diode, field effect devices, bipolar junction transistors, introduction to power devices.
Assessment: Class mark (30%), 2 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Physical Electronics 1
ENEL2PA H1 (20L-5T-6P-0S-34H-10R-0F-0G-5A-13W-8C)
Prerequisite Modules: (CHEM181 and 191) or (CHEM163 and 173).
Aim: To asses materials by their properties for their suitability in electrical and electronic applications. Calculate electronic transport properties of materials and their optical, thermal and magnetic responses. Characterise the properties of p-n junctions and bipolar transistors.
Content: The crystal structure of solids. Introduction to quantum mechanics and the quantum theory of solids. The semiconductor in equilibrium. Carrier transport phenomena. Carrier generation and recombination. The pn junction. The bipolar transistor.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Physical Electronics 2
ENEL2PB H2 (20L-5T-6P-0S-35H-10R-0F-0G-4A-13W-8C)
Prerequisite Modules: ENEL2PA.
Aim: Understand the working of semiconductor components, apply equivalent circuit models and asses frequency limitations. Characterise the operation and limitations of semiconductor devices.
Content: The bipolar transistor, equivalent circuit models, frequency limitations. The Schottky barrier diode and ohmic contacts. Junction field effect transistors. MOSFET devices. Optical devices. The silicon controlled rectifier.

Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Software Engineering 1
ENEL2SE H2   (20L-5T-6P-0S-35H-10R-0F-0G-4A-13W-8C)
Aim: To teach students how to write properly structured computer software to a professional standard.
Content: The activities that make up a typical software development lifecycle including requirements elicitation and analysis, system design and object design. Software development lifecycle modelling. Design and development methodologies. The use of UML in software development activities.
Assessment: Coursework and tests (30%); 2 h exam (70%).
DP Requirement: Performed all laboratory practicals or equivalent assignments satisfactorily, as specified in the module outline.

Workshop Course
ENEL2WS H2   (0L-0T-0P-0S-0H-0R-0F-0G-0A-1W-0C)
Aim: Expose students to safety requirements and basic equipment they will use in design workshops and in preparation for their vacation work.
Content: Electronic: safety and soldering techniques. Use of basic equipment in electrical workshops: power supply, function generator, oscilloscope, digital multi-meters, soldering iron, and a pedestal drill press. Mechanical: safety, cutting, bending and drilling. Use of the pedestal drill press, guillotine, bending brake and the lathe Electrical: safety, earth leakage, wiring up a basic circuit, test for continuity.
Practicals: All instruction takes place in laboratories & workshops.
Assessment: A duly performed certificate of competence.
DP Requirement: Attendance of module.

Analogue Electronics 2
ENEL3AE H2   (20L-5T-6P-0S-24H-20R-0F-0G-5A-13W-8C)
Prerequisite Modules: ENEL3TA.
Aim: To introduce students to the techniques used to design and analyse complex analogue electronic circuits containing passive and discrete active components for practical application. To expose students to more complex design and analysis issues such as frequency response and feedback.
Content: Analogue electronics: small-signal amplifiers. Frequency response analysis and multistage AC and DC coupled amplifiers. Feedback analysis: generalised approach to feedback in two-port networks and its effect on gain, bandwidth, impedance level, distortion and stability. Oscillators and some applications of feedback in selected circuits.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Computer Engineering Design 1
ENEL3CA H1   (10L-22T-0P-0S-45H-0R-0F-0G-3A-13W-8C)
Corequisite: ENEL3TA.
Aim: Design and implement practical product oriented system. Apply theoretical engineering knowledge to practical design. Effectively communicate design concepts in written report and orally. Judge the merit and correctness of solutions to problems. Communicate the logic and detailed approach to problem solving. Work as part of a design team tasked with providing a design solution. Understand the nuances of the social issues confronting business in South Africa.
Content: Design studies and seminars will be conducted on selected topics of interest.
Practicals: Build, test and characterise analogue and digital circuits.
Assessment: 30% Continuous assessment and 70% Final Assessment.
DP Requirement: Not applicable.
This module has no supplementary exam.

Computer Engineering Design 2

ENEL3CB H2   (10L-22T-0P-0S-45H-0R-0F-0G-3A-13W-8C)

Prerequisite Modules: ENEL2WS, ENEL3CA, ENEL3DS.
Aim: To give students the opportunity to participate in the design of computer hardware and software systems. The design process is formally structured to simulate a formal design approach. The design techniques build on those acquired in ENEL3CA Computer Engineering Design 1 module.
Content: Design studies and seminars will be conducted on selected topics of interest to computer engineering students.
Assessment: Report marks (25%), presentation marks (25%); 2 h exam (50%).
DP Requirement: None.

Computer Methods 3

ENEL3CC H1   (20L-0T-20P-0S-25H-10R-0F-0G-5A-13W-8C)

Prerequisite Modules: ENEL2CB.
Aim: Using a high-level independent programming language to explore software systems with a focus on cooperative engineering application development. This will incorporate the use of advanced object orientated programming and basic user interface design.
Content: High-level object orientated programming, associated tools and techniques, cooperative engineering application.
Assessment: Coursework and test (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals or equivalent assignment is required.
Subminimum Requirements: ECSA ELO5 (Engineering method skills and tools including Information Technology) must be achieved.

Communications

ENEL3CO H2   (39L-10T-12P-0S-84H-9R-0F-0G-6A-13W-16C)

Prerequisite Modules: MATH354, STAT370.
Aim: Analyse signals in the frequency domain. Analyse random signals in terms of probability distributions, power spectral densities and correlation. Understand the need for modulation in communication. Understand methods for modulating and demodulating analogue signals. Understand sampling theorem and pulse modulation systems. Understand effects of noise in analogue modulation systems.
Content: Spectral analysis, random variables and processes, amplitude modulation, frequency modulation, the sampling theorem, pulse modulation systems, noise in communication systems.
Assessment: Class mark (30%); 3 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Control Systems 1

ENEL3CS H2   (20L-5T-6P-0S-31H-12R-0F-0G-6A-13W-8C)

Prerequisite Modules: ENEL3SS, MATH354.
Aim: Understand about feedback systems and feedback design.
Content: Block diagrams, feedback and feedforward systems; system specifications in the time and frequency domain; linear system stability; root locus analysis. Nyquist stability theorem; system compensation; differential sensitivity and relative stability; Nichols chart design for tracking and disturbance rejection; PID controllers.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Electronic Design 1

ENEL3DA H1   (10L-22T-0P-0S-45H-0R-0F-0G-3A-13W-8C)

Corequisite: ENEL3TA.
Aim: Design and implement practical product oriented system. Apply theoretical engineering knowledge to practical design. Effectively communicate design concepts in written report and orally. Judge the merit and correctness of

solutions to problems. Communicate the logic and detailed approach to problem solving. Work as part of a design team tasked with providing a design solution. Understand the nuances of the social issues confronting business in South Africa.
Content: Design studies and seminars will be conducted on selected topics of interest.
Practicals: Build, test and characterise analogue and digital circuits.
Assessment: 30% Continuous assessment and 70% Final Assessment.
DP Requirement: Not applicable.
This module has no supplementary exam.

Electronic Design 2
ENEL3DB H2   (10L-22T-0P-0S-45H-0R-0F-0G-3A-13W-8C)
Prerequisite Modules: ENEL2WS, ENEL3DA, ENEL3TA, ENEL3DS.
Corequisite: ENEL3AE, ENEL3DE.
Aim: Translate user requirements into specifications and solutions for an electronic product. Undertake the design process. Demonstrate technical competence. Document the design. Build prototypes and measure performance. Account for the broader implications. Understand the environmental stresses and accommodate for these. Work as a design team. Report on work verbally and in written form.
Content: Design studies and seminars will be conducted on selected topics of interest to electronic engineering candidates.
Practicals: Build, test and characterise analogue and digital circuits & systems.
Assessment: 50% class mark (reports, presentations and lab work) & 50% final assessment (written report & oral presentation).
DP Requirement: Not applicable.
This module has no supplementary exam.

Digital Electronics
ENEL3DE H2   (20L-5T-6P-0S-24H-20R-0F-0G-5A-13W-8C)
Prerequisite Modules: ENEL2EB.
Aim: To provide a study of the design and analysis sequential circuits and to provide an introduction to VHDL.
Content: S-R latch, D-latch, D-FF, S-R FF, J-K FF and T-FF; analysis of hazard effects in sequential circuits; the synchronous finite state machine analysis; the synchronous finite state machine design; feedback sequential circuits analysis; feedback sequential circuits design; sequential MSI components; introduction to VHDL; implementation of digital circuits using VHDL.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Digital Systems
ENEL3DS H1   (40L-11T-12P-0S-60H-32R-0F-0G-5A-13W-16C)
Prerequisite Modules: ENEL2CA.
Aim: Design microprocessor-based systems including peripheral hardware. Analyse a specific requirement and generate appropriate microcontroller hardware and software.
Content: Basic microcontroller architecture, bus timing, assembly language programming, design and development cycle, compilation and linkage. Peripherals, timers, I/O, device interfacing, synchronous and asynchronous I/O. Serial communication protocols. Interrupts, ISRs, prioritisation, triggering, latency. Event driven programme design. Some advanced topics relating to memory architectures, Depp's and other topics.
Assessment: Class mark (30%); 3 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.
Subminimum Requirements: ECSA ELO5 (Engineering methods, skills and tools, including information technology) must be achieved.

Electrical Design 3
ENEL3EA H1   (10L-22T-5P-0S-35H-5R-0F-0G-3A-13W-8C)
Prerequisite Modules: ENEL2EB, ENEL2FT.
Corequisite: ENEL3MA.
Aim: Model and analyse electromagnetic actuators using the Finite Element Method. To work in a team in a structured way.
Content: Principles of finite element analysis of magnetostatic fields, modelling and analysis of electromagnetic circuits and actuators with the help of the finite element method, design and optimisation of electromagnetic actuators based on finite element analysis of the magnetic field. Selection of materials and design of electrical machines and actuators using finite element techniques.
Practicals: Design & testing of machines & actuators.
Assessment: Project reports, design tutorials, mini design project, test.
DP Requirement: Not applicable.
Subminimum Requirements: Students must pass the outcome assessment as part of the requirements of ECSA ELO5 (engineering methods, skills and tools including information technology) and ECSA ELO8 (working in a team).
This module has no supplementary exam.

Electrical Design 4
ENEL3EB H2   (10L-5T-5P-0S-52H-5R-0F-0G-3A-13W-8C)
Prerequisite Modules: ENEL3DS, ENEL2WS, ENEL3TA.
Aim: To understand electrical engineering applications of embedded microcontroller systems. To work in a team in a structured way.
Content: Design and test simple microprocessor systems. Real-Time embedded system control. Design, simulation, building and testing of real time embedded control systems. Interfacing to power electronic devices.
Assessment: Project reports, design tutorials, mini design project, test.
DP Requirement: Not applicable.
Subminimum Requirements: Students must pass the outcome assessment as part of meeting the requirements of ECSA ELO5 (engineering methods, skills and tools including information technology) and ECSA ELO8 (working in a team).
This module has no supplementary exam.

E-M Theory
ENEL3EM H2   (20L-5T-6P-0S-34H-10R-0F-0G-5A-13W-8C)
Prerequisite Modules: ENEL2FT.
Aim: Analyse EM fields, transmission lines and matching problems. Understand EMI/EMC.
Content: PDE's in electromagnetism. Maxwell's equations, time periodic fields. Boundary conditions. Plane wave propagation. Poynting's theorem. Reflection of plane waves, surface resistivity, obliquely incident waves, reflection and refraction, transmission and reflection coefficients, total internal reflection and surface waves. Transmission lines, line equation and reflections. Input impedance, characteristic impedance. Smith chart, applications to matching. Transmission line time domain response. EMC/EMI basic definitions. Solving EMI problems. Testing for EMC.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Electrical Machines 1
ENEL3MA H1   (20L-5T-6P-0S-28H-16R-0F-0G-5A-13W-8C)
Prerequisite Modules: ENEL2EL or ENEL2EA.
Aim: Understand the characteristics and applications of various electrical machines and mechanical loads. Predict electrical and mechanical characteristics of different electrical machines with loads and appreciation of temperature rise. Understand AC to DC current conversion techniques.

Content: DC machines, armature windings, efficiency and speed control. Single and 3-phase transformers, equivalent circuits, phasor diagrams, efficiency, regulation, autotransformers and 3-phase power measurement. Induction motors, equivalent circuits, performance calculations and starting. AC to DC conversion.

Assessment: Class mark (30%); 2 h exam (70%).

DP Requirement: Perform all laboratory practicals satisfactorily, as specified in the module outline.

Subminimum Requirements: The assignment must be passed as part of meeting the requirements of ECSA ELO8 (multidisciplinary work). The assignment must be performed in a team, which includes both mechanical and electrical engineering students. The assignment will include mechanical and electrical components (such as matching mechanical load to machine specifications, motor-gearbox design).

Electrical Machines 2
ENEL3MB H2							(20L-5T-6P-0S-28H-16R-0F-0G-5A-13W-8C)

Prerequisite Modules: ENEL3MA.

Aim: Understand the operation of synchronous machines and their electrical characteristics and testing techniques. Apply phasor-diagram techniques to arrive at numerical solutions for the electrical variables. Understand the operation, analyse and compare the performance of small AC motors under different steady-state operating conditions.

Content: Principles of cylindrical rotor synchronous machines, phasor diagrams, equivalent circuits, torque/load-angle relationships, open and short circuit characteristics, stability and the P-Q chart. Operation and comparison of different types of fractional power and single phase motors.

Assessment: Class mark (30%); 2 h exam (70%).

DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Power Electronics 1
ENEL3PE H2							(20L-6T-6P-0S-31H-12R-0F-0G-5A-13W-8C)

Prerequisite Modules: ENEL2EB.

Aim: Understand power electronics. Convert AC-to-DC. Design elementary alternating current industrial controllers. Understand DC-to-DC conversion. Design elementary DC-to-DC circuits. Predict the performance of basic power electronic industrial systems.

Content: Power switching devices: the switching principle, static and dynamic performance, and heat sinks. Power diodes, packages, snubber circuits, series and parallel operation, ratings, various power transistor types, characteristics and ratings. AC-to-DC conversion, various configurations of AC controllers and DC-to-DC conversion using buck and boost regulators.

Assessment: Class mark (30%); 2 h exam (70%).

DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Power Systems 1
ENEL3PS H2							(40L-30T-10P-0S-40H-35R-0F-0G-5A-13W-16C)

Prerequisite Modules: ENEL3MA.

Corequisite: ENEL3MB.

Aim: Introduction to the field of power systems, power system control, operation and economics.

Content: Generation, transmission and distribution of electrical power. Elementary economics of power generation including pumped storage, power and frequency control. Power flow in power system networks. Transmission line design. Power distribution and metering, tariffs, power factor correction and load control. Tariffs. Power systems subject to symmetric faults. Electrical and mechanical design of overhead transmission for power transfer. Electrical and thermal performance of underground cables. Symmetrical 3-phase short circuits and line drop.

Assessment: Class mark (30%); 3 h exam (70%).

DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Software Engineering 2
ENEL3SF H2							(20L-5T-6P-0S-35H-10R-0F-0G-4A-13W-8C)

Prerequisite Modules: ENEL2SE.

Aim: To provide a broad view of both quality assurance and testing so that students will have a broad awareness of many of the activities that contribute to managing the quality of a software product.

Content: Introduction: software life cycle, role of testing and quality assurance (QA), risk management. Test design techniques: exploratory testing, testing design techniques, system testing, test documentation. Bug isolation and reporting. Static testing; process improvement; overview of automated testing. Object oriented software engineering techniques: an in-depth view to using UML in the design and development of object-oriented software projects.

Assessment: Coursework and tests (30%); 2 h exam (70%).

DP Requirement: Performed all laboratory practicals or equivalent assignments satisfactorily, as specified in the module outline.

Systems & Simulation

ENEL3SS H1   (20L-5T-6P-0S-33H-12R-0F-0G-4A-13W-8C)

Prerequisite Modules: MATH248, (ENEL2EA or ENEL2EL).

Aim: Understand how to model, simulate and analyse dynamic systems.

Content: First-principles, state space models of non-linear lumped parameter systems; numerical simulation - theory and practical implementation; linear systems - models, solutions and analysis; input-output descriptions and frequency domain methods; Bode plots; discrete time systems.

Assessment: Coursework and tests (30%); 2 h exam (70%).

DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Analogue Electronics 1

ENEL3TA H1   (20L-5T-6P-0S-24H-20R-0F-0G-5A-13W-8C)

Prerequisite Modules: ENEL2EB.

Aim: To introduce the techniques used to design and analyse simple analogue electronic circuits containing passive and discrete active components for practical application.

Content: The BJT differential amplifier: configurations, input resistance, output resistance, differential gain, commonmode rejection ratio, common-mode input resistance, current mirrors and multistage amplifiers. S-domain analysis of filters and tuned amplifiers: Butterworth and Chebyshev low pass, high pass and band pass filter responses and their implementation using passive LCR networks and active components in Sallen & Key and piqued circuits. Normalised filter design using frequency and impedance transformations. Field-effect transistors: structure, operation and characteristics of enhancement and depletion type Moser's. MOSFET biasing. MOSFET single-stage amplifier configurations. CMOS digital logic inverter and analogue switch.

Assessment: Class mark (30%); 2 h exam (70%).

DP Requirement: Performed all laboratory practicals satisfactorily, as specified in the module outline.

Design & Analysis of Algorithms

ENEL4AA H1   (14L-6T-12P-0S-29H-15R-0F-0G-4A-13W-8C)

Prerequisite Modules: ENEL2DS, ENEL3CC.

Aim: To present the fundamental techniques for designing efficient computer algorithms, proving their correctness, and analyzing their running times.

Content: Review of algorithm design and analysis: time and space complexity; average and worst-case analysis; asymptotic notation; measuring the asymptotic growth functions; summations; recurrence relations. Divide and Conquer: Max-dominance. Review of sorting and lower bounds: analysis of merge sort, quicksort and heap sort, lower bounds on comparison-based sorting, linear time sorting, randomized selection. Graph algorithms: graph representations, depthfirst and breadth-first search, directed acyclic graphs, minimum spanning trees, and shortest paths. Techniques for problem solving - dynamic programming: knapsack, chain-matrix multiplication, all-pairs shortest paths; longest common subsequence. Technique for problem solving - greedy algorithms: Huffman codes, activity selection. NP-completeness: non-determinism, the classes P and NP, NP-complete problems, polynomial reductions, approximations.

Assessment: Coursework and tests (30%); 2 h exam (70%).

DP Requirement: None.

Subminimum Requirements: ECSA ELO4 (Investigations, experiments and data analysis) must be achieved.

Acoustics
ENEL4AC H1   (20L-2T-12P-0S-33H-9R-0F-0G-4A-13W-8C)
Prerequisite Modules: ENEL3AE.
Aim: Understand vibration in physical systems, the performance of microphones and loudspeakers, the propagation of sound waves in rooms, the design of rooms for good speech intelligibility and how to control the radiation of sound from one room to another.
Content: Electrical, mechanical and acoustical analogies. Propagation of sound waves in different media. Microphones, pressure, pressure-gradient and combination types. Loudspeakers, radiation impedance and factors affecting their performance. Loudspeaker enclosures. Sound in enclosed spaces, reverberation, hearing and speech intelligibility, and sound transmission through walls. Acoustic measurements.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals is required.

Artificial Intelligence
ENEL4AI H2   (14L-6T-12P-0S-32H-12R-0F-0G-4A-9W-8C)
Prerequisite Modules: ENEL3CC.
Aim: This module affords candidates the opportunity of self-study in one or more topics in the field of artificial intelligence.
Content: Suitable topics are chosen by each candidate in consultation with the lecturer concerned at the start of the module. From the topics students should acquire skills to synthesize and present structured and documented solutions incorporating structured knowledge (fuzzy logic), and/or learnt knowledge (artificial neural networks) and adaptive neuron-fuzzy inference models. Deploy such solutions in simulation environments and/or programming languages like ANSI-C where necessary.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals or equivalent assignment is required.

Automation
ENEL4AM H2   (14L-6T-12P-0S-26H-12R-4F-0G-6A-9W-8C)
Prerequisite Modules: ENEL3SS, ENEL3CS.
Aim: Understand the automation process.
Content: The automation process; quality control, including ISO9000; automation technology (PLC's, SCAD's, DC's and embedded systems); function and specification of measurement systems and actuators; process modelling; hazard analysis and safety systems; control and operability studies; batch control; historisation; artificial intelligence; embedded and low-cost automation. Manufacturing execution systems.
Practicals: Extended laboratory project; industrial tour.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: None.
Subminimum Requirements: The module must be passed as part of meeting ECSA ELO2 (application of scientific and engineering knowledge). A 50% average mark on practicals is required as part of meeting ECSA ELO4 (investigation, experimentation and data analysis).

Computer Engineering Design 3
ENEL4CA H1   (0L-10T-44P-7S-85H-11R-0F-0G-3A-13W-16C)
Prerequisite Modules: ENEL3CB, ENEL3AE, ENEL3DE.
Aim: To provide a vehicle for students to participate in and understand the engineering design process from the initial proof-of-concept and determination of need, through the market analysis, product specification, pre-prototype and prototype production and final prototype test and characterization phases. To provide a high stress situation in which group participation and co-operation is an essential in order to foster group working. To provide a situation where multiple, group presentations are required, one of which must be multi-media and concentrate on the non-technical aspects of the design such as financial viability, marketability, aesthetics and usability. To provide a module where entrepreneurial abilities are emphasized in order to prepare students for a probable life of self-employment.

Content: Design studies and seminars conducted on selected topics.
Practicals: Group laboratory design project.
Assessment: Continuous assessment (50%), final assessment (50%).
DP Requirement: None.
Subminimum Requirements: The following ELOs must be achieved: ECSA ELO1 (problem solving), ECSA ELO 2 (application of scientific and engineering knowledge), ECSA ELO 3 (Engineering Design), ECSA ELO 6 (Professional and technical communication), ELO 8 (Individual, team and multidisciplinary working) and ELO 11 (Engineering management).

Computer Engineering Design Project
ENEL4CB H2   (0L-0T-126P-0S-194H-0R-0F-0G-0A-13W-32C)
Prerequisite Modules: ENEL4CA.
Aim: Develop the skills necessary to interpret project specifications and plan the necessary work. Demonstrate an independent ability to solve Electronic Engineering design problems. Demonstrate the ability to assess the feasibility of design ideas, work safely and independently. Present ideas by means of written report, oral presentation with audiovisual aids and by means of a poster.
Content: Perform an individual design to an agreed specification. Present the design by means of a written report and an oral. Exhibit the design project at the School Open Day.
Practicals: Individual laboratory design project.
Assessment: Continuous Assessment (25%), Examination (75%).
DP Requirement: Students are expected to work consistently throughout the semester on their projects. Each student's performance on both the interim oral and interim report will be used to make a decision on the award of a duly performed certificate for the module.
Subminimum Requirements: The project must be passed as part of meeting ELO1 (problem solving), ELO2 (application of scientific and engineering knowledge and, ELO3 (engineering design). The report writing and oral component must be passed as part of meeting ELO6 (professional and technical written and oral communication).

Distributed Computing Systems
ENEL4CC H2   (20L-6T-12P-0S-26H-10R-0F-0G-6A-13W-8C)
Prerequisite Modules: ENEL4OS.
Aim: To design and program multimedia, client-server, web-based, and collaborative systems as well as parallel systems. To develop middleware, e.g. using distributed objects based software, such as CORBA, to interface databases, centralized services and legacy software systems.
Content: Introduction to distributed computing. GUI's, event handling, exceptions, manipulating images, and animations. Client-server systems, networking with sockets and streams. Concurrency, including Multithreading. Parallel computing, domain and functional partitioning, message passing and performance measurements. Collaborative systems, i.e. mobile agents, including security and reliability models.
Practicals: Two project-assignments.
Assessment: Test and projects (30%); 2 h exam (70%).
DP Requirement: None.
Subminimum Requirements: A 50% average mark on practicals is required as part of meeting ECSA ELO4 (investigation, experimentation and data analysis).

E-Commerce Systems
ENEL4CM H1   (20L-5T-6P-0S-35H-10R-0F-0G-4A-13W-8C)
Aim: To teach students about developments in e-commerce systems.
Content: Introduction to e-commerce; goals for e-commerce; b2b and b2c concepts; communication and computing infrastructure requirements; back-office system architectures; databases; data warehousing; ERP system integration; user side tools; security issues; legal issues; money management; some case studies.
Assessment: Coursework and tests (30%); 2 h exam (70%).
DP Requirement: None.

Subminimum Requirements: A 50% average mark on practicals is required as part of meeting ECSA ELO4 (investigation, experimentation and data analysis).

Computer Architecture and Organisation
ENEL4CO H1   (20L-5T-6P-0S-35H-10R-0F-0G-4A-13W-8C)
Prerequisite Modules: ENEL3DS.
Aim: To teach students about the hardware used in computer systems.
Content: Computer architecture; instruction set; number representation; redundant number system; mixed radix system; residue number system; addition principles and structure; carry-ripple adder; carry skip adder; carry look-ahead adder; multiplication of signed numbers; Booth's algorithm; floating point arithmetic; data and control pipelining; effects on performance; the MIPS computer; superscalar computers.
Assessment: Coursework and tests (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals or equivalent assignment is required.

Control Systems 2
ENEL4CS H1   (20L-2T-12P-0S-30H-12R-0F-0G-4A-13W-8C)
Prerequisite Modules: ENEL3CS.
Aim: Understand more about control systems and robust feedback design.
Content: Parametric and non-parametric system identification; frequency domain and quantitative feedback design; digital implementation; introduction to non-linear systems.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals is required.

Electronic Design 3
ENEL4DA H1   (0L-20T-46P-11S-70H-16R-0F-0G-0A-13W-16C)
Prerequisite Modules: ENEL3DA, ENEL3DS, ENEL3DB, ENEL3AE, ENEL3DE.
Aim: Function in self-managed group projects. Have a good awareness of the full scope of the engineering design process. Design a reasonably complex electronic system to match an approved, self-generated product specification. Understand the importance of time and project management and be able to apply common tools to this end. Be aware of a variety of CAD tools to be used in the design process and able to apply some of these tools to create and/or implement a design.
Content: Design studies and seminars conducted on selected topics.
Practicals: Group laboratory design project.
Assessment: Continuous assessment 50%, final assessment 50%.
DP Requirement: None.
Subminimum Requirements: The following ECSA Exit Level Outcomes must be achieved and are assessed separately. ECSA ELO1 (problem solving), ECSA ELO2 (application of scientific and engineering knowledge) and, ECSA ELO3 (engineering Design). The team work component must be passed as part of meeting ECSA ELO8 (individual, team-work and multidisciplinary working). The economic design-making component of ECSA ELO 11 (Engineering Management) must be achieved.
This module has no supplementary exam.

Digital Communications
ENEL4DC H1   (20L-2T-
12P-0S-33H-9R-0F-0G-4A-13W-8C)
Prerequisite Modules: ENEL3CO.
Aim: Characterise digital sources. Determine the information capacity and noise budget of digital communication systems. Understand the effects of noise in digital modulation systems. Analyse the performance of forward error correction systems. Understand optimum receiver and signal apace concepts. Perform a system-level design of digital communication systems.

Content: Waveform coding; PCM, DPCM and Delta modulation. Information theory; entropy, coding of discrete sources, mutual information, channel capacity. Modulation; PSK, DEPSK, DPSK, FSK, MSK, Mary PSK and QAM. Data transmission; the optimum filter for a base-band signal receiver; the matched filter; coherent reception. Coding theory; block codes, convolutional codes, performance of coded systems.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals or equivalent assignments.

Digital Processes
ENEL4DP H1   (20L-2T-12P-0S-33H-9R-0F-0G-4A-13W-8C)
Prerequisite Modules: ENEL3DS, ENEL3DE.
Aim: The student will be able to write VHDL descriptions for circuits to be implemented on FPGA's. Apply microprocessors in the solution of an embedded processor design problem. Analyse the potential performance of an embedded processor design. Create complex logic circuits on FPGA's and use a software package to synthesize the solution.
Content: Embedded Processors: the study of small general purpose micro-controllers for use in embedded applications. Programmable Logic Devices: the study of selected PLD's and the design tools required to use them for complex digital sub-systems.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals or equivalent assignments.

Digital Signal Processing
ENEL4DS H1   (20L-2T-12P-0S-33H-9R-0F-0G-4A-13W-8C)
Prerequisite Modules: ENEL3CO.
Aim: To understand the use of z-transforms in the analysis of discrete linear time invariant systems. Design of FIR and IIR filters using MATLAB and implementation on a DSP chip. Applications of DSP techniques in at least one of the following areas: speech and image processing, communications, medicine.
Content: The z-transform and its application to LTI systems. Frequency analysis of signals and systems. Design of FIR and IIR filters. Finite word length effects. The DFT and the FFT. Multirate DSP. The TMS320C50 DSP.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals or equivalent assignments.

Data Communications
ENEL4DT H1   (14L-6T-12P-0S-35H-9R-0F-0G-4A-9W-8C)
Prerequisite Modules: ENEL3CO.
Aim: Classify communication networks. Analyse the performance of large-scale communication networks. Design a digital data communications network to match desired criteria.
Content: Introduction to computer networks, switching techniques, classes of networks, network structure and protocol layers. The physical layer and medium access modes. The data link layer, error detection and correction and flow control. The network layer, internetworking, bridges, routers and gateways. The transport layer. The session layer. The presentation layer. The application layer, remote file access, electronic mail, virtual terminals and directory services.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals or equivalent assignments.

Electrical Design 5
ENEL4EA H1   (0L-0T-100P-0S-140H-0R-0F-0G-0A-13W-24C)
Prerequisite Requirement: Passed at least 10 Level-3 ENEL modules, ENEL3EA, ENEL3EB.
Aim: Develop the skills necessary to interpret design specifications, plan and execute a design procedure so as to meet such specifications. Demonstrate through project work an independent ability to solve Electrical Engineering design problems. Demonstrate through practical work the ability to assess the feasibility of design ideas, work safely and independently. Present ideas by means of written report and oral presentation with audio-visual aids.
Content: Design studies and seminars will be conducted on selected topics.

Practicals: Laboratory design project.
Assessment: Interim and final written reports and interim and final oral presentations.
DP Requirement: None
Subminimum Requirements: The following ECSA Exit Level Outcomes must be achieved and are assessed separately. ECSA ELO1 (problem solving), ECSA ELO2 (application of scientific and engineering knowledge), ECSA ELO3 (engineering design), ECSA ELO8 (individual working) and ECSA ELO 11 (engineering management - economic decision-making part). This module has no supplementary exam.

Engineering Business
ENEL4EB H1H2   (20L-0T-0P-0S-40H-16R-0F-0G-4A-13W-8C)
Aim: Explain what corporate business is, the different sectors of businesses, sizes of enterprises, business strategy and planning. Read a business balance sheet and measure the performance of the business. Understand marketing principles. Understand the use of labour in business and some industrial relations issues. Be able to explain the role of the engineer in fulfilling business strategy. Explain the need to act professionally and ethically and to exercise judgment and take responsibility within own limits of competence.
Content: An introduction to the concept of corporate business. Business in perspective. Measuring business performance. The market place. The marketing mix. Industrial relations. The future role of manpower in business. Goals and strategy revisited. Impact of Engineers in business. Codes of ethics, professionalism and professional development.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: None.
Subminimum Requirements: There are two assignments. The engineering activity assignment must be passed as part of meeting ECSA ELO7 (sustainability and impact of engineering activity: on public health, occupational health and safety). The professionalism assignment must be passed as part of meeting ECSA ELO10 (engineering professionalism).

Analogue Electronics 3
ENEL4EC H1   (20L-2T-12P-0S-33H-9R-0F-0G-4A-13W-8C)
Prerequisite Modules: ENEL3AE.
Aim: Analyse complex analogue systems as used in the electronics industry. Design and synthesize analogue circuits to match specific requirements. Analyse and compensate for component non-linearities.
Content: The analysis and design of electronic circuits used in communication systems, digital systems, integrated circuits, instrumentation systems and data acquisition systems.
Practicals: Two 6-hr laboratory practicals.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: None.
Subminimum Requirements: Achieve ECSA ELO 4 (investigation, experimentation and data analysis.

Electronic Design Project
ENEL4ED H2   (0L-0T-126P-0S-194H-0R-0F-0G-0A-13W-32C)
Prerequisite Modules: ENEL4DA.
Aim: Develop the skills necessary to interpret project specifications and plan the necessary work. Demonstrate an independent ability to solve Electronic Engineering design problems. Demonstrate the ability to assess the feasibility of design ideas, work safely and independently. Present ideas by means of written report, oral presentation with audiovisual aids and by means of a poster.
Content: Perform an individual design to an agreed specification. Present the design by means of a written report and an oral. Exhibit the design project at the School Open Day.
Practicals: Individual laboratory design project.
Assessment: Continuous Assessment 25%, Examination 75%.

DP Requirement: Students are expected to work consistently throughout the semester on their projects. Each student's performance on both the Interim Oral and Interim Report will be used to make a decision on the award of a duly performed certificate for the module.

Subminimum Requirements: The project component must be passed as part of meeting ELO1 (problem solving), ELO2 (application of scientific and engineering knowledge), ELO3 (engineering design). The report writing and oral component must be passed as part of meeting ELO6 (professional and technical written and oral communication). **This module has no supplementary examination.**

Engineering Entrepreneurship

ENEL4EE H1H2   (20L-0T-0P-0S-40H-16R-0F-0G-4A-9W-8C)

Aim: To identify entrepreneurial characteristics & ability. To be aware of the various types of enterprises. To understand the need to set goals & objectives. To develop a simple business plan. To understand the need for marketing and selling. To identify key operating ratios of an enterprise. To be aware of how people are managed. To be aware of legal commitments of an enterprise.

Content: Overview of the business world & the niche of the entrepreneur. Selecting & funding a business. Vision mission & the business plan. Selling & marketing. Managing the people. Operational considerations & management. Financial management. Legal requirements affecting engineers. The role & impact of engineers in entrepreneurship.

Assessment: Class mark (20%); 2 h exam (80%).

DP Requirement: None.

Electrical Design Project

ENEL4EP H2   (0L-0T-104P-29S-172H-0R-15F-0G-0A-13W-32C)

Prerequisite Modules: ENEL4EA.

Aim: Develop the skills necessary to interpret project specifications and plan the necessary work. Demonstrate an independent ability to solve Electrical Engineering design problems. Demonstrate the ability to assess the feasibility of design ideas, work safely and independently. Present ideas by means of written report, oral presentation with audiovisual aids and by means of a poster.

Content: Perform an individual design to an agreed specification. The scope of the project must be approved by the Electrical Engineering discipline to ensure its suitability to allow students to meet the required exit-level outcomes.

Present the design by means of a written report and an oral report. Exhibit the design project at the School Open Day.

Practicals: Laboratory work as determined by the requirements of the project.

Assessment: Continuous assessment 25%, Examination 75%.

DP Requirement: Students are expected to work consistently throughout the semester on their projects. Each student's performance on both the Interim Oral and Interim Report will be used to make a decision on the award of a duly performed certificate for the module.

Subminimum Requirements: The project component must be passed as part of meeting ECSA ELO1 (problem solving), ECSA ELO2 (application of scientific and engineering knowledge), ECSA ELO3 (engineering design). The report writing and oral component must be passed as part of meting ECSA ELO6 (professional and technical written and oral communication).

This module has no supplementary exam.

Embedded Systems

ENEL4ES H2   (20L-5T-6P-0S-35H-10R-0F-0G-4A-13W-8C)

Prerequisite Modules: ENEL3DS.

Aim: To teach students about various microprocessor, micro controller and digital signal processing chips available and how to use some of them.

Content: The concept of embedded systems; embedded system architecture; CPU types (single chip to complex DSP processor systems); bus systems; I/O systems; ALU capabilities; memory systems; addressing modes; assembler languages; high-level embedded languages; operating systems; use of embedded processing; case studies of various applications.

Assessment: Coursework and tests (30%); 2 h exam (70%).

DP Requirement: None.

Subminimum Requirements: ECSA ELO4 (investigation, experimentation and data analysis) must be achieved.

High Voltage Engineering 1
ENEL4HA H1   (20L-2T-18P-0S-25H-10R-0F-0G-5A-13W-8C)
Prerequisite Modules: ENEL3PS.
Aim: To provide candidates with the necessary theoretical and practical understanding of the design principles and performance of high voltage insulating materials.
Content: Generation and measurement of high voltages for testing purposes. Conduction processes in highly insulating materials. Gas discharges and the streamer mechanism. Processes that lead to failure of gaseous, liquid and solid insulation. Non-destructive testing techniques for evaluating high voltage equipment.
Practicals: Laboratory session plus report.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on practicals is required.
Subminimum Requirements: None

High Voltage Engineering 2
ENEL4HB H2   (14L-6T-8P-0S-32H-15R-0F-0G-5A-9W-8C)
Prerequisite Modules: ENEL3EM, MATH354, ENEL4HA.
Aim: To provide candidates with the necessary theoretical and practical understanding of the design principles of high voltage power systems and the performance of outdoor insulation.
Content: Numerical techniques for calculating electric field distributions in typical geometries. Partial discharge testing. Performance of outdoor insulators in polluted environments. Insulation co-ordination and transmission line design principles. Self-study through literature review related to the design, operation and maintenance of high voltage equipment.
Practicals: One 8 hour laboratory session plus report.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals is required.

Internet Engineering
ENEL4IE H2   (14L-8T-12P-0S-30H-10R-0F-0G-6A-13W-8C)
Prerequisite Modules: ENEL4DT.
Aim: To teach students about the history and development of the engineering concepts embodied in the Internet.
Content: Introduction to TCP/IP and associated protocols (HTTP, FTP, SNMP, SMTP, CGMP etc.); IPv4, IPv6, mobile IP; TCP versus UDP; uni-, multi- and broad-cast addressing and traffic; programming using sockets; datalink access; client/server concepts; Internet standards; typical Internet applications; client/server programming
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals or equivalent assignment is required.

Illumination
ENEL4IL H2   (14L-6T-12P-0S-28H-12R-3F-0G-5A-9W-8C)
Aim: To understand the theory and application of illumination.
Content: Theory: Nature of light, radiation & visible spectrum. Absorption, transmission, reflection & refraction. Photometric concepts, definitions, laws and units. Intensity diagrams and calculations: Intensity distribution, polar curves, iso-candela diagrams and light flux calculations. Point line and surface sources and illumination diagrams. Light sources: Incandescent, fluorescent, mercury, metal-halide and high-pressure sodium lamps. Lighting design: Task analysis, design strategy, SANS standards, interior & exterior lighting and low voltage installations.
Practicals: Two 6-hr laboratory practicals.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals is required.

Instrumentation

ENEL4IN H1 (20L-2T-12P-0S-33H-9R-0F-0G-4A-13W-8C)

Prerequisite Modules: ENEL3TA, ENEL2ED.

Aim: To introduce instrumentation and instrumentation systems & their engineering design; the selection of primary sensors, principles behind process instrumentation. To design instrumentation amplifiers for low level primary signals. To learn electromagnetic interference effects and mitigating strategies.

Content: Standards & units: Revision of basic ideas of traceability, accuracy, repeatability and bandwidth. Electronics for instrumentation: Amplification of small signals from strain gauges and thermocouples. Electromagnetic interference, shielding and grounding, EMC standards. Integrated circuit and micro machined sensors and actuators: Electronic nose, accelerometers. Process instrumentation: Substation instrumentation. Chemical Process instrumentation. Protocols and sensor/actuator integration. Soft sensing. Neural network and rule based interpretation of sensor data, sensor fusion.

Assessment: Class mark (30%); 2 h exam (70%).

DP Requirement: None.

Subminimum Requirements: The module must be passed as part of meeting ECSA ELO2 (application of scientific and engineering knowledge). A 50% average mark on practicals is required as part of meeting ECSA ELO4 (investigation, experimentation and data analysis).

Image Processing

ENEL4IP H2 (20L-5T-6P-0S-35H-10R-0F-0G-4A-13W-8C)

Prerequisite Modules: ENEL4DS.

Aim: To learn how digital images are acquired and processed to achieve objectives including image enhancement and data reduction.

Content: Human visual and image processing system. Digital images and types, image structure, parameters and pixels, image file formats, processing mathematics, image acquisition: hardware, optics, noise. Image processing and analysis: pixel operators, image transforms, image enhancement, image restoration, morphology, image segmentation, image compression and quality assessment metrics.

Assessment: Class mark (30%); 2 h exam (70%).

DP Requirement: A 50% average mark on laboratory practicals or equivalent assignments.

Electrical Machines 3

ENEL4MA H1 (20L-2T-12P-0S-31H-10R-0F-0G-5A-13W-8C)

Prerequisite Modules: ENEL3MB and ENEL3PS.

Aim: Analyse salient pole synchronous machines. Test synchronous machines and measure their basic parameters. Analyse simple electromechanical converters. Deal with simple cases of transient behaviour of synchronous and DC machines. Analyse and calculate performance of closed loop speed control systems of DC motors.

Content: Salient pole synchronous machines, two-axis theory of synchronous machines, principles of electromechanical energy conversion, generalised machine theory, primitive machine, transient behaviour of synchronous machines, transient behaviour of DC machines, closed loop control of DC machines.

Practicals: Two 6-hr laboratory practicals.

Assessment: Class mark (30%); 2 h exam (70%).

DP Requirement: A 50% average mark on laboratory practicals is required.

Electrical Machines 4

ENEL4MB H2 (18L-6T-12P-0S-24H-15R-0F-0G-5A-9W-8C)

Prerequisite Requirement: ENEL3MA.

Aim: Analyse induction machines working in various modes (motoring, generating, braking). Deal with cases of transient behaviour of induction machines, including thermal and mechanical transients. Test and model induction machines.

Content: Analysis of induction machines using equivalent circuit, dynamic braking of induction motors, plugging of induction motors, induction generator, deep bar and double cage induction motors, thermal and mechanical transient behaviour of induction motors, analysis of induction machines using d-q axis theory.
Practicals: Two laboratory sessions.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals is required.

Microwave Systems
ENEL4MS H2   (14L-6T-12P-0S-36H-8R-0F-0G-4A-9W-8C)
Prerequisite Modules: ENEL3EM.
Aim: Analyse and solve simple high frequency networks. Design simple passive microwave components. Explain the operation of some microwave measurement equipment. Analyse and design small signal microwave amplifiers.
Content: S parameters. Spectrum and network analyzer operation. Microstrip design and synthesis with reference to; frequency dependence, loss mechanisms, discontinuity models. Passive microstrip circuits including; multi-section impedance transformers and matching networks. Stepped impedance filters, power dividers, directional couplers and hybrid junctions. Coupled transmission line theory. Microwave CAD: circuit analysis and component models at high frequencies. Small signal microwave amplifiers; specified gain, low noise, biasing and construction.
Practicals: Two 6-hr laboratory practicals.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: None.
Subminimum Requirements: The module must be passed as part of meeting ECSA ELO2 (application of scientific and engineering knowledge). A 50% average mark on practicals is required as part of meeting ECSA ELO4 (investigation, experimentation and data analysis).

Operations Research
ENEL4OR H2   (14L-6T-12P-0S-30H-14R-0F-0G-4A-9W-8C)
Aim: The student will be able to use a methodology effectively by identifying the various courses of action available in a complex operational problem and recommend the best course.
Content: Operations Research phases of an O.R. project; methodology. Linear programming applications; problem formulation; graphical solutions; simplex method. Inventory control: basic EOQ model; quantity discounts; dynamic inventory systems and simulation. Network analysis: planning phase; arrow diagrams; analysis phase. P.E.R.T. and C.P.M.; resource scheduling. Precedence diagrams. Simulation: Use of random numbers; Monte Carlo Method. Forecasting: N-Period moving average; exponential smoothing. Queuing theory: Queue disciplines; arrivals and service patterns; single- and multi-server. Quality and Reliability Engineering. Statistical quality control: process capability; process control; acceptance sampling. Life characteristics: Weibull analysis; systems reliability; maintainability.
Economic life tests; design analysis: reliability testing and prediction.
Assessment: Coursework and tests (30%); 2 h exam (70%).
DP Requirement: None.
Subminimum Requirements: The module must be passed as part of meeting ECSA ELO2 (application of scientific and engineering knowledge). A 50% average mark on practicals is required as part of meeting ECSA ELO4 (investigation, experimentation and data analysis).

Operating Systems for Engineers
ENEL4OS H1   (20L-5T-6P-0S-35H-10R-0F-0G-4A-13W-8C)
Prerequisite Modules: ENEL3CC.
Aim: The student will be able to: Understand the issues involved in concurrent programming including, synchronisation, deadlock, scheduling, memory management, security as used in a typical operating system such as UNIX.
Content: Concurrency issues; process management; threads; inter-process communication; synchronisation; deadlocks; scheduling; memory management; security. UNIX / Linux and Windows examples.

Assessment: Coursework and tests (30%); 2 h exam (70%).
DP Requirement: DP Requirement: A 50% average mark on laboratory practicals or assignment is required.

Power Electronics 2

ENEL4PA H1   (20L-2T-12P-0S-29H-12R-0F-0G-5A-13W-8C)
Prerequisite Modules: ENEL3PE.
Aim: The candidate will be able to: understand DC and AC variable speed drives. Select variable speed drives for various industrial applications. Understand regenerative operation of variable speed drives. Understand the basics of harmonics on the mains. Appreciate how variable speed drives are affected by quality of supply.
Content: AC-to-DC conversion. DC-to-AC conversion. DC and AC variable speed drives and industrial applications. Soft starters. Synchronous motor drives systems. Mains harmonics. Direct torque control of induction motors. Field Orientation Control (FOC) of induction motors. **Practicals:** Two 6-hr laboratory practicals.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: A 50% average mark on laboratory practicals is required.

Power Electronics 3

ENEL4PB H2   (14L-6T-12P-0S-32H-12R-0F-0G-4A-9W-8C)
Prerequisite Modules: ENEL4PA.
Aim: This is a self-study module. The candidate will be able to: Understand basic Power Electronics Systems in practical applications. Design elementary conversion configurations. Design DC-to-DC conversion equipment. Design AC-to-DC conversion equipment. Design and predict the performance of basic Power Electronic industrial Systems.
Content: This module follows on from ENEL4PA and affords each candidate the opportunity of self-study in one or more topics in the field of Power Electronics. Each candidate in consultation with the lecturer chooses a suitable topic.
Practicals: Two 6-hr laboratory practicals.
Assessment: Coursework and tests (50%); 2 h exam (50%). Student must demonstrate independent learning ability to meet ECSA exit-level outcome 9.
DP Requirement: A 50% average mark on practicals is required.

Real Time Computing

ENEL4RC H2   (20L-5T-6P-0S-35H-10R-0F-0G-4A-13W-8C)
Aim: This is a self-study module where students will investigate and study issues involved in designing computer systems that are able to operate at speeds enabling real time processing of digital signals.
Content: Real-time system concepts; hard real-time and embedded systems; timing and scheduling as applied to periodic and aperiodic processes; hard versus soft deadlines; predictability, granularity and determinacy; rate monotonic and earliest deadline scheduling; real-time software and operating systems; real-time languages; real-time software design; reliability and fault tolerance in hardware and software; case studies.
Assessment: Coursework and tests (50%); 2 h exam (50%).
DP Requirement: None.
Subminimum Requirements: ECSA ELO9 (Independent learning ability) must be achieved.

Selected Topics in Electrical Engineering 1

ENEL4SA H1   (14L-6T-12P-0S-32H-10R-0F-0G-6A-9W-8C)
Prerequisite Requirement: Has completed at least 96 credits at Level 3 plus any other specialist pre-requisite required by the module lecturer.
Aim: This is a self-study module. To give students the opportunity to study in a specialty field in electrical engineering that is not covered in existing modules and for which there is a demand by a number of students, but subject to availability of suitable lecturing staff.
Content: Topics selected from new & current disciplines in the field of electrical engineering. The selected topics are directed towards increasing the students' working knowledge of the latest technologies and analytical techniques in electrical engineering.
Practicals: There may be two 6-hr laboratory practicals.

Assessment: Coursework and tests (50%); 2 h exam (50%).
DP Requirement: Pass the laboratory practical or equivalent assignment.
Subminimum Requirement: ECSA ELO9 (Independent learning) must be achieved in the practical or assignment.

Selected Topics in Electrical Engineering 2
ENEL4SB H2   (14L-6T-12P-0S-32H-10R-0F-0G-6A-9W-8C)
Prerequisite Requirement: Has completed at least 96 credits of level 3 plus any other specialist pre-requisite required by the module lecturer.
Aim: This is a self-study module. To give students the opportunity to study in a specialty field in electrical engineering that is not covered in existing modules and for which there is a demand by a number of students, but subject to availability of suitable lecturing staff.
Content: This module covers topics selected from new and current disciplines in the field of electrical engineering. The lectures are directed towards increasing the students' working knowledge of the latest technologies and analytical techniques in electrical engineering.
Practicals: There may be two 6-hr laboratory practicals.
Assessment: Coursework and tests (50%); 2 h exam (50%).
DP Requirement: Perform all assignment satisfactorily according to the course outline.
Subminimum Requirement: ECSA ELO9 (Independent learning) must be achieved in the practical or assignment.

Superconductivity
ENEL4SC H2   (14L-6T-12P-0S-37H-7R-0F-0G-4A-9W-8C)
Prerequisite Modules: ENEL2PB.
Aim: To provide an insight into applications of superconductors and a thorough understanding of properties, limitations and behaviour of superconducting electrical and electronic devices. The module also gives an overview of the current development in the field and creates awareness of the nonlinear behaviour of superconducting devices.
Content: Introduction to characteristic properties: normal metal vs superconductor, Meissner effect, type-I type-II superconductors, critical currents, flux quantization. Phenomenological theory: London model, thermodynamics and superconducting state, Ginzburg Landau Theory, surface and interface effects. Josephson effects: tunnel effects, DC Josephson effects. Effect of a magnetic field, AC Josephson effect, Josephson coupling, RCSJ Model and Weak link effect. Electrical and electronic applications: superconducting type-II cables/tapes, DC SQUIDS, analogue flux-locked loops and superconducting electronics.
Practicals: One 6-hr laboratory practical.
Assessment: Class mark (30%); 2 h exam (70%).
DP Requirement: 50% average mark on laboratory practical or equivalent assignments.

Security and Encryption
ENEL4SE H1   (20L-0T-6P-0S-35H-10R-0F-0G-4A-13W-8C)
Prerequisite Modules: MATH349.
Aim: To teach students about security and encryption systems and their applications.
Content: Encryption system concepts; cyphers; block & stream cypher systems; concepts of authentication, verification, non-repudiation; examples of popular cypher systems, DES, PGP, RSA, RC2, DH; key management; certificates & certification agencies; Biometrics. Databases and their security.
Assessment: Coursework and tests (30%); 2 h exam (70%).
DP Requirement: DP Requirement: A 50% average mark on laboratory practicals or equivalent assignment is required.

Power System Stability
ENEL4SS H2   (14L-6T-12P-0S-25H-15R-2F-0G-6A-9W-8C)
Prerequisite Modules: ENEL3CS, ENEL4MA, ENEL4WA.

Aim: To Introduce the concepts of interconnected power systems and the factors that influence their operation. To introduce typical stability problems in modern systems, causes and approaches. The students will also be exposed to the levels of mathematical model required to analyse different power system stability phenomena.

Content: The stability problem and the characteristics of modern power systems. Equipment characteristics and modelling: synchronous machines; AC transmission; excitation systems; prime movers; control of active and reactive power. Small-signal, transient and voltage stability in power systems; subsynchronous oscillations. Methods of improving stability.

Practicals: Two 6-hr laboratory practicals.

Assessment: Class mark (30%); 2 h exam (70%).

DP Requirement: A 50% average mark on practicals is required.

Selected Topics in Computer Engineering 2

ENEL4ST H2   (14L-6T-12P-0S-32H-10R-0F-0G-6A-13W-8C)

Prerequisite Requirement: Has completed at least 96 credits of level 3 plus any other specialist pre-requisite required by the module lecturer.

Aim: To give students the opportunity to study in a specialty field in computer engineering that is not covered in existing modules and for which there is a demand by a number of students, but subject to availability of suitable lecturing staff.

Content: This module covers topics selected from new and current disciplines in the field of Computer Engineering. The lectures are directed towards increasing the candidates' working knowledge of the latest technologies and analytical techniques in Computer Engineering.

Practicals: Two 6-hr laboratory practicals.

Assessment: Coursework and tests (25%); 2 h exam (75%).

DP Requirement: Pass the laboratory practical or equivalent assignment.

Communication Systems

ENEL4SY H2   (14L-6T-12P-0S-26H-14R-4F-0G-4A-9W-8C)

Prerequisite Modules: ENEL3CO, ENEL4DC.

Aim: To see where the principles of communications are applied. To introduce the students to communications systems that they will encounter immediately they take up employment.

Content: Satellite communication systems: an introduction to the fundamentals of satellite communication systems; orbit types, the space segments, ground stations, link budgets, modulation schemes, multiple access types and beam switching. Direct broadcast systems (DBS), geo-stationary and low earth orbit systems and services; the Intelsat and INMARSAT systems. Cellular communication systems: principles of cellular communications systems, multiple access techniques, mobile propagation, channel modelling, analogue, digital cellular, personal communication services. Optical communication systems: optical fibre fundamentals; fibre properties, fibre link components, optical transmitters and receivers, splices connectors and couplers. Optical link design. Fibre-optic networks. Wavelength division multiplexing. Fibre fabrication and measurements.

Assessment: Class mark (30%); 2 h exam (70%).

DP Requirement: None.

Subminimum Requirements: The module must be passed as part of meeting ECSA ELO2 (application of scientific and engineering knowledge). A 50% average mark on practicals is required as part of meeting ECSA ELO4 (investigation, experimentation and data analysis).

Selected Topics in Electronic Engineering 1

ENEL4TA H1   (14L-6T-12P-0S-32H-10R-0F-0G-6A-9W-8C)

Prerequisite Requirement: Has completed at least 96 credits of level 3 plus any other specialist pre-requisite required by the module lecturer.

Aim: Students should have the ability to understand in reasonable depth the theory and practice of the particular topic, thus enabling them to proceed with post-graduate studies in this field or apply their knowledge to practical situations.

Content: This module covers topics selected from new and current disciplines in the field of Electronic Engineering.

The lectures are directed towards increasing the candidates' working knowledge of the latest technologies and analytical techniques in Electronic Engineering.

Practicals: Two 6-hr laboratory practicals.

Assessment: Continuous assessment 30%, examination 70%.

DP Requirement: Pass the laboratory practical or equivalent assignment.

Selected Topics in Electronic Engineering 2

ENEL4TB H2   (14L-6T-12P-0S-32H-10R-0F-0G-6A-9W-8C)

Prerequisite Requirement: Has completed at least 96 credits of level 3 plus any other specialist pre-requisite required by the module lecturer.

Aim: In this self-study module students should have the ability to understand in reasonable depth the theory and practice of the particular topic, thus enabling them to proceed with post graduate studies in this field or apply their knowledge to practical situations.

Content: This module covers topics selected from new and current disciplines in the field of Electronic Engineering. The lectures are directed towards increasing the candidates' working knowledge of the latest technologies and analytical techniques in Electronic Engineering.

Practicals: Two 6-hr laboratory practicals.

Assessment: Class mark (50%); 2 h exam (50%).

DP Requirement: None.

Subminimum Requirement: Achieve ECSA ELO 9 (Independent learning ability) which is based on the candidate's topic presentation.

Selected Topics in Computer Engineering 1

ENEL4TC H1   (14L-6T-12P-0S-32H-10R-0F-0G-6A-9W-8C)

Prerequisite Requirement: Has completed at least 96 credits of level 3 plus any other specialist pre-requisite required by the module lecturer.

Aim: To give students the opportunity to study in a specialty field in computer engineering that is not covered in existing modules and for which there is a demand by a number of students, but subject to availability of suitable lecturing staff.

Content: This module covers topics selected from new and current disciplines in the field of computer engineering. The lectures are directed towards increasing the students' working knowledge of the latest technologies and analytical techniques in computer engineering.

Practicals: Two 6-hr laboratory practicals.

Assessment: Coursework and tests (25%); 2 h exam (75%).

DP Requirement: Pass the laboratory practical or equivalent assignment.

VLSI Design

ENEL4VL H2   (14L-6T-12P-0S-32H-10R-0F-0G-6A-13W-8C)

Prerequisite Modules: ENEL3TA, ENEL3DS.

Aim: To understand the main suite of tools that are available for VLSI design, and how they work together to support the design flow of a project. Understand the capabilities and limitations of each individual tool from their external interfaces and roles in the design process. To use modern CAD tools for VLSI design. Understand how computers can be programmed to help in the design of very-large-scale integrated (VLSI) circuits.

Content: Procedures for designing and implementing digital integrated systems. Design environments: system level, algorithm level, component level and layout level. Structured design technology and design tools: synthesis tools; cell contents generation and manipulation, generators of layout outside the cell, silicon compilers, post-layout generators. Static analysis tools; node extraction, geometrical design-rule checkers, electrical-rule checkers, verification. Dynamic analysis tools; circuit-level simulation, logic-level simulation, functional- and behavioural-level, simulation issues, evendriven simulation, hardware and simulation. Output of design aids; circuit boards, integrated circuits, implementation issues. Stick diagrams and graphics: display graphics, hardcopy graphics, and input devices. Scalable design rules.

Assessment: Coursework and tests (30%); 2 h exam (70%).

DP Requirement: None.

Subminimum Requirements: A 50% average mark on practicals is required as part of meeting ECSA ELO4 (investigation, experimentation and data analysis).

Vacation Work
ENEL4VW H2   (0L-0T-0P-0S-0H-0R-0F-0G-0A-12W-0C)

Aim: An appreciation of a realistic working environment, enabling candidates to consider their studies in context.

Content: This is a Duly Performed requirement for the BScEng degree in Electrical, Electronic or Computer Engineering. Vacation work is to be arranged and undertaken by students during the course of the degree in fields relevant to their degrees. A total of 13 weeks must be accumulated. A report on the work conducted is to be submitted to the school within six weeks of the conclusion of each vacation work period, together with a certificate of progress from the firm concerned, in which the actual period is also stated.

Assessment: Two Reports acceptable in terms of scientific method, synthesis, computer use and presentation.

DP Requirement: Satisfactory completion of vacation work reports.

Power Systems 2
ENEL4WA H1   (20L-2T-12P-0S-20H-20R-0F-0G-6A-13W-8C)

Prerequisite Modules: ENEL3PS & ENEL3MB.

Aim: Analyse and solve faulted power system networks for protection co-ordination of electrical equipment. Acquire a knowledge of earthing systems and practices, surge and over-voltage protection. Steady state and transient stability of one and two machine systems. Asymmetrical faults and symmetrical component analysis. Electrical protection using relays and fuses. Surge and overvoltage protection. Load flow in simple networks. Analysis of large networks using Z and Y-bus matrices.

Practicals: Two 6-hr laboratory practicals.

Assessment: Class mark (30%); 2 h exam (70%).

DP Requirement: A 50% average mark on laboratory practicals is required.

Subminimum Requirements: ECSA ELO4 (investigation, experimentation and data analysis) must be achieved in the practical.

Power Systems 3
ENEL4WB H2   (14L-6T-12P-0S-33H-10R-0F-0G-5A-9W-8C)

Prerequisite Modules: ENEL4WA.

Aim: This is a self-study module. Knowledge and understanding of power systems. Report writing and presentation skills. Group/team work. Interact and obtain information from industry and consultants. Time management, appointment making, interviewing and planning skills.

Content: A variety of power system topics are provided to choose from. Students select topics and then research the area of concern and provide weekly reports, which also form the lectures to one another. A list of twenty topics relevant to the field of power systems is provided and individual or group project suggestions are welcomed.

Practicals: Two 6-hr laboratory practicals.

Assessment: Class mark (50%); 2 h exam (50%).

DP Requirement: A 50% average mark on laboratory practicals is required.

Mechanical Engineering
Offered in the School of Engineering

Engineering Drawing
ENME1DR H1 P1   (9L-30T-0P-0S-20H-12R-0F-0G-9A-13W-8C)

Aim: To provide basic information and skills to be able to read and understand drawings as a language for engineering communication and explain the fundamental principles of projection and drawing practice.

Content: Geometrical constructions. Isometric projection (pictorial representation). 1st and 3rd angle orthographic projection, including hidden detail, dimensioning, theory of sectional & auxiliary views, and conventional representations.

Interpenetrations and developments. CAD (computer-aided drawing). Tutorials on the above.

Assessment: Drawings: tutorials and tests (12.5%); CAD: tutorials and test (37.5%); 3 h exam (50%).

DP Requirement: Attendance at all tests, 50% for the CAD component.

Mechanical Engineering Design

ENME1ED H2   (20L-35T-3P-0S-1H-1R-12F-0G-8A-13W-8C)

Aim: To be able to configure an appropriate design process and select appropriate materials and manufacturing processes.

Content: The design process, characteristics and properties of materials, specific materials and alloys. Introduction to strengths of materials. Primary and secondary manufacturing processes. Advanced CAD (computer aided drawing).

Limits and fits. The theory, design and construction of a micro steam car. Industrial visits.

Practicals: Construction of a working micro steam car.

Assessment: Assignment, tutorials and steam car competition (12%), tests (18%); 2 h exam (70%).

DP Requirement: Attendance at all tests, a minimum of 50% for the CAD component, a working model of a steam car, attendance at four industrial visits.

Introduction to Engineering Materials

ENME1EM H2   (20L-10T-0P-0S-25H-21R-0F-0G-4A-13W-8C)

Aim: The candidates will acquire a basic understanding of materials, their structure and its influence on the physical and mechanical properties; crystallographic structures, defects in these structures and how this influences the mechanical properties; the mechanical properties of materials; and phase diagrams and how microstructures are formed.

Content: Introduction to materials, structure of materials, crystal imperfections, mechanical behaviour of materials, alloys and properties of alloys, equilibrium phase diagrams.

Assessment: Tests, assignments/tutorials (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all tests and to complete all assignments satisfactorily, as specified in the module outline.

Computer Fundamentals

ENME2CF H1   (20L-30T-0P-0S-15H-12R-0F-0G-3A-13W-8C)

Aim: To provide students with an understanding of computer architecture and hardware. To acquire fluency with a variety of software packages. To gain expertise in computer programming and computational methods and the skill to apply these to specific engineering examples, as well as an ability to operate communication software packages.

Content: Introduction to computers, introduction to computer arithmetic, computer languages, programming, debugging, computational methods, specific professional software packages and communication software packages.

Assessment: Tutorials, test (30%); 2 h exam (70%). The exam consists of a theoretical and a programming section. A sub-minimum of 40% is required for each section.

DP Requirement: Students are required to attend all tests and to complete all tutorials satisfactorily, as specified in the module outline.

Design Methods

ENME2DM H2   (30L-30T-0P-0S-56H-36R-0F-0G-8A-13W-16C)

Prerequisite Modules: ENME1DR, ENME1ED.

Aim: To design components commonly found in Mechanical Engineering applications such as permanent and detachable fasteners, power screws, springs, flexible power transmission components, gears, and shafts.

Content: Structural and machine riveting. Threaded forms and standards, static screw stresses, screw efficiency. Tension and compression helical wound springs. Disk clutches, drums, disk and band brakes. Flat and V-belts,

toothed belts and roller chains. Spur gear forces and static strength of spur gear teeth. Shaft dimensions, coupling and bearings.

Assessment: Tests and assignments (30%); 3 h exam (70%).

DP Requirement: Students are required to attend all tests and to complete all assignments satisfactorily, as specified in the module outline.

Dynamics

ENME2DY H1   (20L-20T-6P-0S-15H-14R-0F-0G-5A-13W-8C)

Prerequisite Modules: MATH142.

Aim: To develop in the student the ability to analyze problems in the area of engineering dynamics in a logical and deductive manner.

Content: General motion of a rigid body. Motion in moving reference frame. Planar motion. Graphical techniques. Instantaneous centre of rotation in planar motion. The equations of motion of a rigid body. Kinetic energy. Principle of work and energy. Potential energy. Fundamentals of analytical dynamics.

Practicals: Problem solving using MATLAB.

Assessment: Tests, assignments/tutorials (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all tests and to complete all assignments/tutorials satisfactorily, as specified in the module outline.

Fluid Mechanics I

ENME2FM H1   (20L-10T-6P-0S-22H-18R-0F-0G-4A-13W-8C)

Prerequisite Modules: MATH142.

Aim: An introductory course designed to establish an understanding of basic fluid dynamics concepts, an ability to apply the basic laws in analysing simple engineering fluid flow problems and to provide a foundation for studying advanced fluid dynamics topics. Fluid as a continuum, fluid properties, dimensions and units. Fluid statics, buoyancy and floatation. Continuity, the momentum equation: impact of a jet, reaction at a nozzle, forces at pipe bends, momentum theory of a propeller, the angular momentum equation. The energy equation, Bernoulli's equation with and without friction. Flow measurement, flow visualisation. Dimensional analysis and similarity.

Assessment: Tests; practicals (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all class tests and to complete all practicals satisfactorily, as specified in the module outline.

Measurements & Experimental Methods

ENME2MM H2   (10L-0T-16P-0S-31H-20R-0F-0G-3A-13W-8C)

Aim: To provide students with an understanding of the concepts of measurements of engineering parameters, dimensional analysis, error calculations, SI units, accuracy, devices and to give them the skill to apply this to resolve instrumentation problems.

Content: Measurement of experimental parameters, measurement techniques and devices, accuracy and uncertainty, SI units, error calculations and dimensional analysis.

Practicals: 8 practicals related to measurement systems.

Assessment: Practicals, test (45%); 2 h exam (55%).

DP Requirement: Students are required to attend the class test and to complete all practicals satisfactorily, as specified in the module outline.

Materials Strength

ENME2MS H1   (20L-10T-0P-0S-28H-18R-0F-0G-4A-13W-8C)

Prerequisite Modules: MATH142.

Aim: To provide students with an understanding of the mechanics of materials and tools to solve simple design problems in the behaviour of structural components.

Content: Basic concepts of elasticity, stress and strain. Compound bars, thin pressure vessels, compound tubes. Shear force diagrams, bending moment diagrams and bending stresses in beams. Torsion of shafts. Close-coiled helical springs.
Assessment: Tests (30%); 2 h exam (70%).
DP Requirement: Students are required to attend all tests and complete assignments.

Fundamentals of Physical Metallurgy

ENME2PM H1   (20L-10T-0P-0S-22H-23R-0F-0G-5A-13W-8C)
Prerequisite Modules: ENME1EM.
Aim: To provide students with basic information and understanding of the kinetics of phase changes in metals, and heat treatments of ferrous and non-ferrous alloys and their influence on the properties of the material.
Content: Nucleation, solidification & growth, diffusion, iron-carbon phase diagram, hardening and tempering, surface treatment, dispersion and precipitation hardening, recovery and recrystallization.
Assessment: Tests, assignment/tutorial (30%); 2 h exam (70%).
DP Requirement: Students are required to attend all tests and to complete the assignment satisfactorily, as specified in the module outline.

Strength of Materials 1

ENME2SM H2   (30L-20T-0P-0S-65H-40R-0F-0G-5A-13W-16C)
Prerequisite Modules: ENME1ED & MATH142.
Aim: To provide students with basic know-how regarding the behaviour of selected structure groups under various types of loading.
Content: Techniques for solving for stresses and deflections of torsional shafts, bending and buckling in beams, trusses, frames, and machines. Shear stresses and strains, temperature effects on components, complex loading, as well as tools for dealing with statically determinate structures, also form part of the syllabus.
Assessment: Tests, assignment with formal report (30%); 3 h exam (70%).
DP Requirement: Students are required to attend all tests and to complete the assignment satisfactorily, as specified in the module outline.

Thermofluids

ENME2TF H1   (20L-10T-0P-0S-28H-18R-0F-0G-4A-13W-8C)
Prerequisite Modules: PHYS152.
Aim: To provide students with foundational principles in thermodynamics and fluid mechanics.
Content: Systems, work and heat transfer. Zeroth, 1st and 2nd laws of thermodynamics. Conservation: of mass, energy and momentum, the Bernoulli equation. Entropy: reversibility, efficiency and steam tables. Elementary cycles: heat engine, reversed engine, Carnot cycle, Rankine cycle and steam turbines. Manometry: use of manometers, ventures to measure flow rates.
Assessment: Tests (30%); 2 h exam (70%).
DP Requirement: Students are required to attend all tests.

Thermodynamics 1

ENME2TH H1   (20L-10T-0P-0S-25H-20R-0F-0G-5A-13W-8C)
Aim: An understanding of the fundamental properties of gases and condensable vapours needed for thermodynamic analysis. To be able to apply the conservation of energy and mass in closed and open systems which involve work transfer, expansion, compression processes, heating, cooling and velocity changes.
Content: Fundamental concepts such as the system, thermodynamic properties, work and heat transfer. The 1st law of thermodynamics (conservation of energy) for closed and open systems. Gas laws, adiabatic processes for gases. The 2nd law of Thermodynamics, basic heat engine performance, entropy. Thermodynamic processes: isochoric, isobaric, isothermal. Steam tables and charts.
Assessment: Tests (30%); 2 h exam (70%).
DP Requirement: Students are required to attend all tests.

Workshop Training

ENME2WS H2   (0L-0T-0P-0S-0H-0R-0F-0G-0A-2W-0C)

Aim: Candidates to acquire an appreciation and basic skills in common fabrication techniques, and familiarize themselves with the structure and function of common mechanical engineering and machine shop equipment items.

Content: Practical workshop instruction and experience includes methods of measurement, jointing & welding, material forming, heat treatment, precision drilling, shaping, turning, etc., with fitting (assembly/disassembly). The use of common hand tools, lathes, and drilling & milling equipment will be covered.

Assessment: Students must earn a duly performed certificate.

DP Requirement: Satisfactory completion of training.

Design of Machine Elements

ENME3DM H1   (30L-30T-0P-0S-58H-34R-0F-0G-8A-13W-16C)

Prerequisite Modules: ENME2DM, ENME2SM.

Aim: To acquire expertise in safety and reliability for the design of engineering components and systems as well as knowledge of impact forces and effects as well as fracture and fatigue.

Content: Selection of failure theories, safety factors and reliability prediction. Stress and deflection caused by bending and torsional loads. Stress intensity factors, high cyclic fatigue life prediction. Bolted joints subjected to fatigue loads. Welded joints under tri-axial loads. Spur, helical bevel and worm gear forces and static strength. Gear teeth surface fatigue strength analysis. Overall shaft design, material selection, fatigue considerations, coupling and bearings.

Assessment: Tests, design project assignment and report (30%); 3 h exam (70%).

DP Requirement: Students are required to attend all tests and to complete the assignment satisfactorily, as specified in the module outline.

Fluid Mechanics II

ENME3FM H2   (40L-10T-9P-0S-60H-36R-0F-0G-5A-13W-16C)

Prerequisite Modules: ENME2FM.

Aim: To learn fluid mechanics fluid mechanics concepts for flows that the engineer will encounter in industry. The ability to apply these concepts to engineering type flow problems and fluid flow design problems.

Content: The Navier-Stokes equations. Laminar flow in pipes, ducts and channels. Turbulent flow: structure of turbulence, universal velocity laws, friction laws, turbulent flow in pipes. Lubrication: tilting pad, journal and thrust bearings. Potential flow, stream function, vorticity. Boundary layer theory: laminar and turbulent boundary layers, the reduced Navier-Stokes equations, exact and approximate solutions, separation. Compressible flows: flow in ducts with area change, Fanno and Rayleigh flows, the normal shockwave. Introduction to numerical solution of fluid flow problems.

Assessment: Class mark (30%); 3 h exam (70%).

DP Requirement: Students are required to attend all tests and to complete the laboratory practicals satisfactorily, as specified in the module outline.

Heat & Mass Transfer 1

ENME3HM H2   (30L-20T-6P-0S-59H-40R-0F-0G-5A-13W-16C)

Aim: To assess the magnitude of heat transfer by conduction, convection and radiation and in mixed environments. To determine the performance of devices that rely on heat and mass transfer.

Content: Conduction: conduction rate equation, heat diffusion equation, two and three-dimensional conduction with internal heat generation and unsteadiness in Cartesian, polar and spherical coordinates. Radiation: fundamental concepts, radiation between surfaces, radiation shape factors and radiant heat transfer. Convection: laminar and turbulent convective heat flow. Reynolds' analogy. Forced and free convection. Boiling and condensing flows, Ficks' law, diffusion in gases and vapours. Fluid friction/heat transfer analogies. Mass transfer correlations. Shell and tube heat exchanger design.

Assessment: Tests (30%); 3 h exam (70%).

DP Requirement: Students are required to attend all tests and to complete all practicals satisfactorily, as specified in the module outline.

Manufacturing Technology

ENME3MT H2   (20L-10T-0P-0S-30H-16R-0F-0G-4A-13W-8C)

Aim: To learn engineering principles of manufacturing processes and machine tools: manufacturing, economics and optimisation problems.

Content: Manufacturing processes, production machines, and tooling and systems. Mechanics of material removal processes: metal machining, the Merchant equation, power and energy relationships. Cutting tool technology: tool wear, tool life and the Taylor equation, tool materials and geometry. Machining operations & machine tools. Selection of cutting conditions, and machining economics. Metal working processes. Bulk deformation in metalworking: rolling, forging, extrusion. Sheet metalworking: cutting operations, bending operations, drawing. Product design considerations.

Assessment: Tests (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all class tests.

Selection of Engineering Materials

ENME3SM H2   (20L-5T-12P-0S-20H-19R-0F-0G-4A-13W-8C)

Prerequisite Modules: ENME2PM.

Aim: To learn about engineering materials & applications in order to correctly select materials for a given design.

Content: Introduction to corrosion, non-destructive testing, fracture mechanics, carbon and alloy steels, cast irons, stainless steels, tool steels, aluminium alloys, copper alloys, nickel and cobalt alloys, magnesium and zinc alloys, ceramics, composites, engineering plastics, wear, advanced surface treatments, metallurgy of welding. Selection methodologies.

Practicals: Metallography - preparation of samples and observation of microstructures of metals, mechanical properties of materials, heat treatments of ferrous and non-ferrous alloys, and the metallurgy of welding.

Assessment: Tests, assignment/tutorial, practical reports (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all tests and to complete the assignments and practical reports satisfactorily, as specified in the module outline.

Strength of Materials 2

ENME3ST H1   (30L-20T-9P-0S-65H-31R-0F-0G-5A-13W-16C)

Prerequisite Modules: ENME2SM.

Aim: To perform analysis for continuous beams, plates, shells, thick cylinders and disks, including the use of numerical and energy methods for stress-strain problems.

Content: Stresses and strains of inclined planes. Principal stresses and strains, Mohr's circle, constitutive equations, plane stress and plain strain. Energy methods, theories of failure. Analysis of thick disks, and pressure vessels. Elementary plasticity, including methods of plastic analysis of beams, cylinders, rotating disks, and limit design. Method of forces and method of displacements applied to statically indeterminate frames.

Assessment: Tests (30%); 3 h exam: (70%).

DP Requirement: Students are required to attend all laboratory practicals and tests, and to complete the laboratory reports satisfactorily, as specified in the module outline.

Thermodynamics 2

ENME3TH H2   (20L-10T-9P-0S-20H-16R-0F-0G-5A-13W-8C)

Prerequisite Modules: ENME2TH.

Aim: To apply basic thermodynamics to the operation and behaviour of real machinery such as gas compressors, piston engines, gas turbines, jet engines, refrigeration plant and steam power plant.

Content: Vapour power cycles. Piston engine cycles, Otto & diesel cycles. Gas turbines, jet engines, refrigeration cycles and steam plant.

Assessment: Test (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all tests and to complete the practicals satisfactorily, as specified in the module outline.

Theory of Machines

ENME3TM H2   (20L-10T-3P-0S-26H-16R-0F-0G-5A-13W-8C)

Prerequisite Modules: ENME2DY.

Aim: To provide the student with an insight into the theory of multibody mechanical systems and into the modern computer-aided techniques applied in the analysis and synthesis of moving assemblies.

Content: Constraint Equations. Computer formulation and solution of the kinematic problem. Kinematics of planar mechanisms. Kinematic analysis using MATLAB models. Force analysis of mechanisms: Planar dynamics. The computer method for dynamic analysis of constrained mechanical systems. Dynamic analysis using MATLAB models. Computer modelling environments.

Assessment: Tests, assignments (30%); 3 h exam (70%).

DP Requirement: Students are required to attend all tests and to complete all assignments satisfactorily, as specified in the module outline.

Advanced Manufacturing Systems

ENME4AM H1   (20L-5T-8P-0S-28H-15R-0F-0G-4A-13W-8C)

Prerequisite Modules: ENME3MT.

Aim: To equip students to function effectively as manufacturing engineers in the context of the modern manufacturing environment.

Content: Fundamental concepts and models for manufacturing, basic manufacturing engineering, process engineering, numerically controlled (NC) systems and NC part programming, CNC and adaptive control techniques, group technology, automation concepts and strategies, CAD/CAM and computer integrated manufacturing (CIM), flexible manufacturing systems (FMS), modern trends in advanced manufacturing systems, factories of the future.

Assessment: Tests, practical reports (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all tests and to complete all practicals satisfactorily, as specified in the module outline.

Subminimum Requirements: The exam must be passed as part of meeting ECSA ELO2 (application of scientific engineering knowledge). The practicals must be passed as part of meeting ECSA ELO4 (investigations, experiments and data analysis).

Engineering Computational Methods

ENME4CM H1   (10L-20T-0P-0S-22H-15R-0F-0G-13A-13W-8C)

Prerequisite Modules: ENME3ST, ENME3FM.

Aim: To provide the students with an ability to analyse, design and synthesize complex engineering systems using computational techniques.

Content: An introduction to finite element method, including analysis of plane trusses and frames and the solution of continuum mechanics problems. Analysis of fluid mechanics and heat transfer problems with finite elements. An introduction to commercial FEM software. The application of these packages for the analysis and solution of problems in solid mechanics, fluid mechanics and heat transfer.

Assessment: Assignments (30%), tests (20%); 2 h exam (50%).

DP Requirement: Students are required to attend all tests and pass all assignments.

Subminimum Requirements: The exam must be passed as part of meeting ECSA ELO5 (engineering methods, skills and tools, including information technology). The assignment must be passed as part of meeting ECSA ELO9 (independent learning ability).

Design & Analysis of Manufacturing Processes

ENME4DM H1   (20L-10T-0P-0S-30H-16R-0F-0G-4A-13W-8C)

Corequisite: ENME4AM.

Aim: The design and analysis of manufacturing processes and design problems related to the manufacturing processes, structures and systems.

Content: Non-traditional machining and thermal cutting processes (ultrasonic machining, abrasive water jet cutting, chemical and electrochemical machining processes, electric discharge machining). Manufacturing processes for

plastics, extrusion, injection moulding, compression moulding, blow moulding. Design, analysis and manufacturing technologies for composites. Modelling, analysis and design optimization of manufacturing processes. Design for manufacturing. Concurrent engineering.
Assessment: Tests (30%); 2 h exam (70%).
DP Requirement: Students are required to attend all tests.

Design & Research Project 2
ENME4DP H2   (10L-0T-0P-20RS-30H-0R-0F-80G-0E-100A-13W-24C)
Prerequisite Requirement: ENME4PD.
Aim: To understand the design process and apply this in real engineering situations. Experience in: teamwork, specification development, concept generation and selection, analysis and synthesis, data collection and interpretation, written and verbal communication.
Content: Each team is presented with a general project definition and is required to perform the following tasks: Problem Solving, Research Driven Investigations, and Solution Generation; Engineering Design and Analysis; Experiments, Data Collection and Analysis; Validation of Designs and Solutions; Professional & Technical Communication; Engineering Management.
Assessment: Oral Presentation (10%), Open Day Poster Presentation (10%), Professional Practice Assignment (10%), Supervisor's Mark (10%), Dissertation (60%).
DP Requirement: Attend all professional practice lectures and pass the professional practice assignment (ECSA ELO10). Pass the oral presentation (ECSA ELO6).
Subminimum Requirements: Students must pass all ECSA Exit Level Outcome subsections in the final dissertation to meet ECSA ELO1 (problem solving), ECSA ELO2 (application of scientific and engineering knowledge), ECSA ELO3 (engineering design), ECSA ELO4 (investigations, experiments and data analysis), ECSA ELO5 (Engineering methods, skills and tools, including information technology), ECSA ELO6 (professional and technical communication), ECSA ELO7 (sustainability and impact of engineering activity), ECSA ELO8 (individual, team & multidisciplinary working), ECSA ELO9 (independent learning) and ECSA ELO11 (engineering management). The assignment on engineering professionalism must be passed as part of meeting ECSA ELO10 (engineering professionalism). The oral presentation must be passed as part of meeting ECSA ELO6 (professional and technical communication). ECSA Accreditation.

Mechanical Engineering Design
ENME4ED H2   (20L-10T-0P-0S-30H-15R-0F-0G-5A-13W-8C)
Prerequisite Modules: ENME3ST.
Aim: To enable the students to undertake advanced design work and to perform design optimization involving materials and geometry of common engineering structures.
Content: Techniques of optimisation, optimal design formulation, application to mechanical component design, material selection charts, performance indices, optimum material design, case studies.
Assessment: Tests, assignment (30%); 2 h exam (70%).
DP Requirement: Students are required to attend all tests.

Energy Management
ENME4EM H2   (20L-10T-0P-0S-30H-15R-0F-0G-5A-13W-8C)
Aim: To enable students to manage large scale energy systems.
Content: Energy resources. Energy production distribution. Renewable and non-renewable energy. New processes, process change, new methods. Energy conservation approaches, energy conservation through process integration. Case studies in the food, petrochemical, power, and metallurgical industries.
Assessment: Tests (30%); 2 h exam (70%).
DP Requirement: Students are required to attend all tests.

Alternative Energy Systems
ENME4ES H1   (20L-10T-0P-0S-30H-15R-0F-0G-5A-13W-8C)

Prerequisite Modules: ENME3FM.

Aim: To enable students to choose among different energy systems and design energy producing systems.

Content: Introduction. Types of conventional and alternative energy sources - renewable and non-renewable sources. Fundamentals of energy conversion processes (energy conversion laws and principles, energy conversion equations, conservation of energy, mechanical, electrical, chemical and thermal energy). Principles of application. Conversion systems: solar thermal energy, solar photovoltaic, geothermal energy, wind energy, biomass/biogas, ocean thermal energy, tidal energy, nuclear energy, magneto-hydrodynamics (MHD), fuel cells, hydro energy, fuel energy (coal, petroleum, natural gas, etc.). Conventional and alternative energy systems design, analysis and performance.

Assessment: Tests (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all tests.

Fracture & Fatigue of Engineering Materials

ENME4FF H2   (20L-10T-0P-0S-30H-15R-0F-0G-5A-13W-8C)

Prerequisite Modules: ENME3DM.

Aim: To provide the students with an understanding of fracture and fatigue design techniques, to enable them to analyse fracture and fatigue failures.

Content: The role of failure prevention analysis in design. Modes of mechanical failure. Concept of cumulative damage, life prediction and fracture control. Use of statistics in fatigue analysis. High and low-cycle fatigue. Fretting fatigue and fretting wear. Laboratory demonstration of fracture and fatigue failures.

Assessment: Tests, tutorials, assignment (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all tests, tutorials, lab demonstrations and to complete all assignments satisfactorily, as specified in the module outline.

Design of Fluid Power Systems

ENME4FP H1   (20L-10T-0P-0S-30H-16R-0F-0G-4A-13W-8C)

Prerequisite Modules: ENME3FM.

Aim: To provide an understanding of the operation of equipment used in fluid power systems and to develop the ability to design such systems.

Content: Design and operation of centrifugal and axial flow pumps: Impeller blade and guide vane geometry, velocity triangles, dynamic and Euler heads. Efficiencies and net positive suction head. Pumps in systems: Series and parallel operation, application of commercial pump curves, similarity of rotodynamic machines. Design and operation of impulse and reaction turbines: Pelton, Kaplan and Francis turbines, velocity triangles, power losses and efficiencies. Design and operation of double- and single-acting positive displacement pumps, pressure indicator diagrams, separation and air vessels.

Assessment: Two tests, an assignment (30%); 2h exam (70%).

DP Requirement: Students are required to attend all class tests and to complete the assignment satisfactorily, as specified in the module outline.

Subminimum Requirements: The exam must be passed as part of meeting ECSA ELO1 (problem solving). The assignment must be passed as part of meeting ECSA ELO3 (engineering design).

Mechanics of Composite Materials

ENME4MC H1   (20L-10T-0P-0S-30H-15R-0F-0G-5A-13W-8C)

Prerequisite Modules: ENME3ST.

Aim: To enable the students to undertake design and analysis work involving composite components.

Content: Micromechanics of fibre reinforced composites, stress/strain analysis of orthotropic materials and laminated composites, failure analysis of laminated composites, design with composites.

Assessment: Tests (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all tests.

Selected Topics in Mechanical Engineering 1

ENME4ME H1   (20L-10T-0P-0S-30H-15R-0F-0G-5A-13W-8C)

Aim: Candidates will demonstrate: an ability to understand a topic of engineering importance and to be able to apply it in theory or in practice; a broader perspective of engineering activities which may facilitate progression into postgraduate studies in this field.

Content: Lectures and seminars involving elements of experimentation, computing, analysis and design in traditional areas of Mechanical Engineering such as thermodynamics, fluid mechanics, manufacturing and solid mechanics.

Assessment: Tests (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all tests.

Selected Topics in Mechanical Engineering 2
ENME4MN H2   (20L-10T-0P-0S-30H-15R-0F-0G-5A-13W-8C)

Aim: Candidates will demonstrate: An ability to understand a topic of engineering importance and to be able to apply it in theory or in practice; a broader perspective of engineering activities which may facilitate progression into postgraduate studies in this field.

Content: Lectures and seminars involving elements of experimentation, computing, analysis and design in traditional areas of Mechanical Engineering such as thermodynamics, fluid mechanics, manufacturing and solid mechanics.

Assessment: Tests (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all tests.

Mechatronic Engineering
ENME4MT H2   (20L-10T-0P-0S-27H-20R-0F-0G-3A-13W-8C)

Prerequisite Modules: ENME3MT.

Corequisite: ENEL3CS.

Aim: To provide students with an understanding of the ability to apply and integrate mechanical and electrical components or devices to control processes or machines to achieve control engineering objectives.

Content: Modelling of systems and implementation of mechatronic methods of control. Measurement and actuating systems for robots and manufacturing, signal conditioning. Adaptive control, communication systems (interfacing computers), microprocessors, input/output systems for microprocessors, programmable logic controllers, design and mechatronics and neural networks.

Assessment: Tests, assignment (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all tests and pass the assignment.

Subminimum Requirements: The exam must be passed as part of meeting ECSA ELO2 (application of scientific and engineering knowledge). The assignment must be passed as part of meeting ECSA ELO5 (engineering methods, skills and tools, including information technology).

Mechanical Vibrations
ENME4MV H2   (20L-10T-0P-0S-30H-15R-0F-0G-5A-13W-8C)

Prerequisite Modules: ENME2DY.

Aim: To provide the student with the ability to analyze and to solve a broad spectrum of vibration problems found in mechanical engineering practice.

Content: Vibrations of undamped and damped systems, response under rotating unbalance, response under moving support, vibration isolation, vibration measurements and signal analysis. The eigenvalue problem and eigenvectors. Modal analysis of conservative systems.

Assessment: Tests, assignment (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all tests and pass the assignment.

Subminimum Requirements: The exam must be passed as part of meeting ECSA ELO1 (problem solving)**.**

Design & Research Project 1
ENME4PD H1   (10L-0T-0P-20RS-45H-0R-0F-40G-0E-45A-13W-16C)

Prerequisite Requirement: Student must be in a position to complete the degree within 3 semesters.

Prerequisite Modules: ENME2WS, ENME3DM.

Aim: To develop the ability of students to work in a team which can take a broad statement of a problem, convert it into engineering terms, and produce an acceptable product which solves the problem. Skills in writing complex technical reports and oral presentations, as well as the ability to produce working prototypes will be developed.

Content: Teams and the dynamics of engineering teamwork. Each team is presented with a general project definition and is required to perform the following tasks: Problem Solving, Research Driven Investigations, and Solution Generation; Engineering Design and Analysis; Validation of Designs and Solutions; Professional & Technical Communication; Engineering Management.
Assessment: Assignments (30%), dissertation (70%).

DP Requirement: Complete all assignments satisfactorily. Submit a satisfactory manufacturing drawing file.
Subminimum Requirements: Students must pass all ECSA Exit Level Outcome subsections in the final dissertation to meet ECSA ELO1 (problem solving), ECSA ELO2 (application of scientific and engineering knowledge), ECSA ELO3 (engineering design), ECSA ELO5 (Engineering methods, skills and tools, including information technology), ECSA ELO6 (professional and technical communication), ECSA ELO7 (sustainability and impact of engineering activity), ECSA ELO8 (individual, team and multidisciplinary working), ECSA ELO9 (independent learning) and ECSA ELO11 (engineering management).

Rocket Propulsion 1
ENME4RP H1   (20L-10T-0P-0S-30H-12R-0F-0G-4A-13W-8C)
Prerequisite Modules: ENME3FM, ENME3TH
Aim: To provide students with an understanding of rocket propulsion elements and propulsion design methods.
Content: History of rocket propulsion. Rocket propulsion fundamentals: Tsiolkovsky's rocket equation, thrust equation, characteristic velocity, nozzle geometry and design. Solid rockets: regression rate, grain design, termination systems. Liquid rockets: turbopump operation and design, propellant selection and stoichiometry, injector design, cooling considerations and thrust chamber design. Hybrid rockets: propellant configurations, non-classical regression rate theory. Delta V budget and escape velocity calculation, and staging. Launch Application, orbital mechanics, satellite insertion and interplanetary transfer.
Assessment: Class mark: 30% (Test). Final exam: (70%).
DP Requirement: Students are required to attend all class tests and to complete all tutorials.

Thermodynamics 3
ENME4TD H1   (20L-10T-0P-0S-26H-20R-0F-0G-4A-13W-8C)
Prerequisite Modules: ENME3TH.
Aim: To introduce students to the methods of analysis of mixtures of gases and condensable vapours, combustion processes, the high speed flow through nozzles and diffusers and their application to the thermodynamics of turbines and compressors.
Content: Mixtures of perfect gases and condensable vapours, specific and relative humidity, the psychrometric chart, evaporative cooling towers. High speed flows, total temperature and enthalpy, Mach number, convergent/divergent ducts, normal shock waves. Energy exchanges and pressure changes in axial impulse and reaction turbines, axial compressor blading and the boundary layer limitation on stage pressure rise.
Assessment: Tests, assignments (30%); 2 h exam (70%).
DP Requirement: Students are required to attend all tests and to complete all assignments satisfactorily, as specified in the module outline.

Vacation Work
ENME4VW H2   (0L-0T-0P-0S-0H-0R-0F-0G-0A-12W-0C)
Aim: An appreciation of a realistic working environment, enabling candidates to consider their studies in context.
Content: This is a Duly Performed requirement for the BScEng (Mechanical) degree. Vacation work is to be arranged and undertaken by students during the course of the degree in fields relevant to mechanical engineering. A total of 12 weeks must be accumulated. A report on the work conducted is to be submitted to the department within six weeks of the conclusion of each vacation work period, together with a certificate of progress from the firm concerned, in which the actual period is also stated.

Assessment: Reports acceptable in terms of scientific method, synthesis, computer use and presentation.
DP Requirement: Satisfactory completion of vacation work reports.

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Property Development (Constructions Studies)

Offered in the School of Engineering

Introduction to the Built Environment
ENPD1BE H2   (26L-9T-0P-17S-17H-6R-0F-0G-5A-13W-8C)
Aim: An appreciation of the processes and participants within the built environment, and to provide basic study skills.
Content: An introduction to the property/construction industry including the structure of the industry, roles of the professions and employer/employee bodies and the macro-economic context. An overview of construction procurement systems to meet client needs and expectations. A view of anticipated future developments within the international and local construction sectors. Development of communication skills by using mind mapping, academic writing, and IT-based techniques.
Practicals: Interaction with architectural students and presentation of assignments in open forums.
Assessment: Assignments, tests (30%); 3 h exam (70%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Intro to Design Appraisal & Measurement
ENPD1DM H2   (35L-10T-17P-0S-58H-35R-0F-0G-5A-13W-16C)
Aim: To enable students to critically appraise design documentation and to select and apply price determination production techniques.
Content: Design appraisal involves an understanding of, amongst other things, the design function, building morphology and the importance of construction technology. The selection and application of price determination production techniques requires a study of the techniques themselves in addition to associated topics, for example, documentation, cost data, cost indices, etc. Introduction to general principles of measuring and Bills of Quantities production.
Practicals: Application of the latest versions of industry measuring guides, and analyzing bills of quantities to build a cost database.
Assessment: Assignments (40%); 4 h exam (60%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Construction Drawing
ENPD1DW H1   (11L-0T-32P-0S-37H-0R-0F-0G-0A-13W-8C)
Aim: To equip students to read and understand drawings, and to be able to communicate via freehand sketches with participants in the construction industry.
Content: Documentation conventions. Production of orthographic and axonometric projections, perspectives, shadow casting and freehand sketching of relevant construction details. Production of a series of working drawings (site plan, floor plan, sections, elevations and details) for simple single storey buildings. An introduction to computer aided design (CAD).
Practicals: Construction drawing in free-hand and using CAD. Field trips to buildings and building sites relevant to achieving aim.
Assessment: Controlled practical sessions (50%); test under exam conditions (50%).
DP Requirement: Students are required to attend all lectures and complete all practicals and assignments satisfactorily, as specified in the module outline.
This module has no supplementary exam.

Construction Technology & Processes 1A

ENPD1TA H1 (35L-17T-0P-0S-62H-15R-26F-0G-5A-13W-16C)

Aim: To provide students with a basic understanding of the processes of construction from the overall procurement process focussing on the erection of a simple, single storey dwelling.

Content: Building technology: structural components of simple, single storey buildings, construction materials. Building processes: briefing, site selection and usage, design, tendering and erection.

Practicals: Field trips to building sites, manufacturers of materials and submission of assignments implementing procedures covered in lectures.

Assessment: Site report (10%) assignments (10%), tests (20%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Construction Technology & Processes 1B

ENPD1TB H2 (35L-0T-17P-0S-62H-15R-26F-0G-5A-13W-16C)

Prerequisite Requirement: ENPD1TA

Aim: This module follows ENPD1TA continuing with the provision of a basic understanding and knowledge of the processes of construction involved in the erection of a simple, single storey dwelling.

Content: (i) The processes and materials involved in finishing and servicing simple, single storey dwellings (ii) The Programme of Land Surveying provides a site survey component.

Practicals: Field trips to building sites, manufacturers of materials and submission of assignments implementing procedures covered in lectures.

Assessment: Tests and assignments (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all lectures and complete all practicals and assignments satisfactorily, as specified in the module outline.

Design Appraisal & Measurement 2A

ENPD2DA H1 (32L-0T-21P-0S-91H-12R-0F-0G-4A-13W-16C)

Prerequisite Modules: ENPD1DM.

Aim: To enable students to produce Bills of Quantities based on the latest versions of industry measuring guides, and provide an understanding of pricing bill items.

Content: Principles of measurement, taking-off quantities using appropriate methods, design appraisal, abstracting and billing. An introduction to and a study of the standard documents involved in this process, for example, standard system, model preambles, model preliminaries, model bill, contract document, etc., pricing selected bill items.

Practicals: Production of a Bill of Quantities for a particular building project using a combination of manual methods of 'taking off' abstracting and billing.

Assessment: Assignments & tests (40%); 4 h exam (60%).

DP Requirement: Students are required to attend all lectures and complete all practicals and assignments satisfactorily, as specified in the module outline.

Design Appraisal & Measurement 2B

ENPD2DB H2 (26L-9T-17P-0S-91H-7R-6F-0G-4A-13W-16C)

Prerequisite Requirement: ENPD2DA.

Aim: To enable students to produce Bills of Quantities, based on the latest versions of industry measuring guides, and provide an understanding of pricing bill items.

Content: Measurement principles, 'taking-off' quantities using appropriate methods, design appraisal, abstracting and billing. An introduction to and a study of the standard documents involved in this process, for example, standard system, model preambles, model preliminaries, model bill, contract document, etc., pricing selected bill items.

Practicals: Production of Bills of Quantities for a particular building project using a combination of manual methods of "taking off" abstracting and billing.

Assessment: Assignments & tests (40%); 4 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Construction Economics & Management 2A
ENPD2EA H1 (35L-12T-0P-10S-65H-33R-0F-0G-5A-13W-16C)
Aim: To provide an understanding of economic principles related to the construction industry and to be able to apply the principles in an international environment.
Content: Relevance of economics in the construction industry. Legal requirements for operation in an international environment. Economic indicators in the construction industry. Logistics of construction projects.
Assessment: Assignments (40%); 3 h exam (60%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all assignments and tutorials satisfactorily, as specified in the module outline.

Construction Economics & Management 2B
ENPD2EB H2 (35L-12T-0P-10S-66H-32R-0F-0G-5A-13W-16C)
Aim: To provide an understanding of management principles pertaining to the construction industry.
Content: Codes of Practice and ethics relevant to construction management. Organisational theory and structures. Project specifications and preliminaries. Business and scenario planning. Decision making. Human resource management. Modern management approaches and preparation of a work plan.
Assessment: Assignments & tests (40%); 3 h exam (60%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all assignments and tutorials satisfactorily, as specified in the module outline.

Construction Technology & Processes 2A
ENPD2TA H1 (35L-0T-13P-0S-74H-20R-13F-0G-5A-13W-16C)
Prerequisite Modules: ENPD1TA & ENPD1TB.
Aim: To familiarise students with the concepts of technology, resource requirements, programming and cost analysis associated with various building types.
Content: Thermal acoustic and fire properties and requirements. Construction methods involving steel frames, portal frames and shell roofs. Waterproofing and flat roofs, and lightweight claddings and coverings.
Practicals: Site surveys and data presentation.
Assessment: Assignments & tests (40%); 3 h exam (60%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all assignments and tutorials satisfactorily, as specified in the module outline.

Construction Technology & Processes 2B
ENPD2TB H2 (35L-0T-13P-0S-74H-20R-13F-0G-5A-13W-16C)
Prerequisite Requirement: ENPD2TA.
Aim: To familiarise students with alternate forms of construction of reinforced concrete frames, including the usage of plant and equipment and the applicable statutory health and safety considerations.
Content: Foundation considerations including dewatering, piling, underpinning, shoring and basement construction. Slab types including prestressing and post tensioning, formwork and movement joints.
Practicals: Site investigations and data presentation.
Assessment: Assignments & tests (40%); 3 h exam (60%).
DP Requirement: Students are required to attend all lectures and complete all practicals and assignments satisfactorily, as specified in the module outline.

Construction Contracts
ENPD3CC H2 (20L-6T-6P-0S-31H-6R-6F-0G-5A-13W-8C)
Prerequisite Requirement: LAWS1LS (40%).

Aim: To introduce standard building contract forms in common usage, sub contract documentation, and the relationship between this formal documentation, common law principles and delict.
Content: Model preliminaries. Development of construction contracts in South Africa. International forms of contract. How to make appropriate choices and recommendations regarding the form of contract to be employed on a project. Targeted procurement procedures.
Assessment: Case study presentation and test (30%); 3 h exam (70%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Design Appraisal & Measurement 3A
ENPD3DA H1   (26L-9T-17P-0S-65H-6R-32F-0G-5A-13W-16C)
Prerequisite Modules: ENPD2DA & ENPD2DB.
Aim: To develop the procurement documentation expertise of students by application of Standard System of Measuring Building Work clauses to the measurement of framed reinforced concrete multi-storey structures.
Content: Students are set various measuring tasks on specific projects to afford them contact with actual conditions in the workplace. Aspects covered: bulk earthworks; column bases, foundation beams, various slab forms together with columns, beams, staircases.
Practicals: Real-life case studies.
Assessment: Assignments & tests (40%); 4 h exam (60%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Design Appraisal & Measurement 3B
ENPD3DB H2   (26L-15T-17P-0S-91H-6R-0F-0G-5A-13W-16C)
Prerequisite Requirement: ENPD3DA (40%).
Aim: To equip students to undertake the production of bills of quantities for complex, multi-storey buildings. To promote an understanding of principles relating to the synthesis of prices for construction units.
Content: Piling, structural steel, handrailings, sheet roofing, flat roof coverings. Preparation and pricing documents for preliminaries, tender forms, bills of quantities rates including sub-contract items.
Practicals: Real-life case studies.
Assessment: Assignments & tests (40%); 4 h exam (60%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Construction Economics & Management 3A
ENPD3EA H1   (47L-32T-0P-0S-34H-42R-0F-0G-5A-13W-16C)
Prerequisite Modules: ENPD2EB.
Aim: To introduce students to the operations of the development industry. Further to consider appropriate forms of procurement across a broad spectrum of project types.
Content: Issues in development projects, procurement and contemporary management principles applied to various development projects, including land access, financial and marketing management, planning, implementation and community participation. Job creation. Urban dynamics.
Assessment: Assignments & tests (40%); 3 h exam (60%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all assignments and tutorials satisfactorily, as specified in the module outline.

Project Planning
ENPD3PL H1   (48L-12T-0P-0S-80H-10R-0F-0G-10A-13W-16C)
Prerequisite Requirement: Students must be registered in at least the 3rd year of study.
Aim: To equip candidates with the skills and knowledge of technology necessary for the effective planning and control of sizeable projects.

Content: Module content of ENPD3PP supplemented. Investigation of alternative information systems and the choice thereof. Using technology for project documentation sharing and interoperability. Setting up projects. Data structures for management and control purposes. Time analysis. Networks. Resources and resource smoothing. Project documentation. Soft logic. Customising planning software for special purposes. Sharing project information with a web based application.

Assessment: Assignments & tests (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all assignments and tutorials satisfactorily, as specified in the module outline.

Project Management

ENPD3PM H2   (36L-6T-16P-0S-162H-15R-0F-0G-5A-13W-24C)

Prerequisite Requirement: Students must be registered at least in the 3rd year of study.

Aim: To provide a conceptual framework for the discipline of project management. Management of construction projects. Appreciation of environmental complexity and change.

Content: Systems thinking. Design management: Understanding the design process. Human resource management: leadership in project management, project team building, negotiation strategies, communication skills. Project strategy: procurement strategy, characteristics of construction projects, the role of the client, conflicting project objectives. Theory of construction project management: formulation of project strategy, project organisation structure. Conflict management.

Assessment: Assignments & tests (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Property Law

ENPD3PR H2   (36L-9T-0P-9S-84H-17R-0F-0G-5A-13W-16C)

Aim: Develop an understanding of the basic principles of property law in South Africa.

Content: Legal classification of immovable property in South Africa; the concept, acquisition, exercising, and loss of rights over immovable property; statutes and ordinances affecting property development and valuation in South Africa.

Assessment: Tests & assignment (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all assignments and tutorials satisfactorily, as specified in the module outline.

Property Studies

ENPD3PS H1   (36L-9T-0P-9S-84H-17R-0F-0G-5A-13W-16C)

Prerequisite Requirement: Students must be registered at least in the 3rdyear of study.

Aim: To introduce students to the nature of land ownership, use and development and the financial tools required for the evaluation of development and investment opportunities. Develop practical skills in financial mathematics used in the property industry.

Content: Basic principles on the functioning of the property market. Differing land uses and the influence of the external environment. Economics of real property. Land tenure and forms of ownership. Mathematics of finance. Investment in real property. Principles of property development. Introduction to property finance. Introduction to viability studies. Laws pertaining to property.

Assessment: Tests & assignment (30%); 3 h exam (70%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all assignments and tutorials satisfactorily, as specified in the module outline.

Construction Technology & Processes 3A

ENPD3TA H1   (17L-0T-17P-0S-13H-15R-13F-0G-5A-13W-8C)

Prerequisite Modules: ENPD2TA & ENPD2TB.

Aim: The study of advanced building construction and services.

Content: Critical evaluation of design layouts and detailing in relation to viability of cost, ease of construction and aesthetic acceptability. The production process relating to the interaction of specialist services within the context of the overall building programme for complex and specialist buildings.

Practicals: Practical case study.

Assessment: Assignments & tests (40%); 3 h exam (60%).

DP Requirement: Students are required to attend all lectures and complete all practicals and assignments satisfactorily, as specified in the module outline.

Cost Engineering

ENCS7CE H1   (20L-0T-0P-0S-40H-0R-0F-60G-40A-15W-16C)

Aim: Display an understanding of the client briefing process and the importance of effective communication. Recognise the long and short-term impact of properly planned construction costs. Consider and apply whole life costs through life cycle costing.

Content: The client briefing process; the theory and techniques of construction cost planning and control; design economics; cost and price indices; pricing of contract preliminaries - profit and overheads. The preparation of price forecasts; communication applied to the cost planning and management environment; risk management and risk analysis; life cycle costing; artificial intelligence and expert systems; facilities management. The cost-centred approach to viability studies.

Assessment: Assignments (40%); 3h examination (60%).

DP Requirement: Attendance of all class sessions and timeous completion of all assigned work. Students have to obtain a passing grade of at least 50% mark in assignments to obtain DP..

Advanced Construction Technology

ENCS7CT H1   (20L-0T-5P-0S-40H-0R-0F-55G-40A-15W-16C)

Aim: To provide students with an understanding of advanced concepts in construction technology and practice, integrating technology, management and economics. The provision of engineering services and infrastructure design and documentation, and appropriate, alternative technology for residential township development..

Content: Lean construction. Detailed construction method statements, site establishment, applications of laws and regulations pertaining to construction sites. Smart materials and artificial intelligence. Health and safety planning and practical applications. Plant equipment selection. Industrial building systems.

Practicals: A field trip to a construction project or site where advanced construction technology is being applied.

Assessment: Assignments (40%); 3h examination (60%).

DP Requirement: Attendance of all class sessions and timeous completion of all assigned work. Students have to obtain a passing grade of at least 50% mark in assignments to obtain a DP.

Applied Construction Management

ENCS7CM H2   (40L-0T-0P-0S-80H-0R-0F-120G-80A-15W-32C)

Prerequisite: ENCS7PA.

Aim: To prepare students for the management of a construction site including construction health and safety, work study and method statements, site planning, plant management, management of construction project risk.

Content: Practical application of project management processes that ensure the effective flow of the project throughout its life cycle including site organizational structure; site establishment and organization; time, cost and quality management; legislated and practical requirements relative to construction health and safety; work study in theory and practice within a construction site environment; preparation and use of method statements; procurement and supply chain management; selection and management of construction plant equipment.

Assessment: Major assignment and presentation (100%). No supplementary examination.

DP Requirement: None.

Advanced Project Measurement and Finance

ENCS7PF H1   (20L-0T-0P-0S-40H-0R-0F-60G-40A-15W-16C)

Aim: To provide students with an understanding of advanced measurement and financial management of construction projects.

Content: Advanced measurement; feasibility studies; tender preparation, submission and evaluation; cash flow projections; cash reports and budgets; interim payment certificates; final account preparation; professional fee accounts; cost/price adjustment (escalation) applications..

Assessment: . Assignments (40%); 3h examination (60%).

DP Requirement: Attendance of all class sessions and timeous completion of all assigned work. Students have to obtain a passing grade of at least 50% mark in assignments to obtain a DP.

Project Administration

ENCS7PA H1   (20L-0T-0P-0S-40H-0R-0F-60G-40A-15W-16C)

Aim: To introduce specialist management techniques in the construction industry, in the areas of site management, process and production management, and specialist management.

Content: Site management: work study, plant and equipment selection and management, site layout and planning, site health and safety. Process and production management: business complexity, competition, linear and non-linear programming, decision theory.   Specialist management: life cycle costing, value management, total quality management, lean construction, business process re-engineering, sustainability, procurement methods for major projects.

Assessment: Integrated assessment including formative and summative assessments made up of assignments (30%) and a final assessment that is made up of a written submission and presentation of a portfolio of all completed work (70%). No supplementary examination.

DP Requirement: Attendance of all class sessions and timeous completion of all assigned work. Students have to obtain a passing grade of at least 50% mark in assignments to obtain a DP.

Research Methodology

ENCS7RM H1   (40L-0T-0P-40S-60H-0R-0F-0G-20A-15W-16C)

Aim: To develop the skills of students as researchers investigating in depth a particular issue for the construction industry.

This forms the foundation for a research report to be completed as part of Research Report.

Content: Data acquisition - the use of library resources; selecting and justifying a research topic; planning the research project; literature searching; analysing data; gathering data; data processing packages for research output management; executing the research; presentation of the research findings.

Assessment: Continuous assessment of the research proposal (100%). No supplementary examination.

DP Requirement: Report of satisfactory progress by supervisor..

Research Report

ENCS7RR H2   (0L-0T-0P-0S-288H-32R-0F-0G-0A-15W-32C)

Prerequisite: ENCS7RM

Aim: To research a defined topic illustrating creativity, critical analysis, synthesis, evaluation, discrimination and academic objectivity. To provide evidence of management if own study within pre-determined objectives and present the work cogently.

Content: This module flows directly from Research Methodology (ENCS7RM) and registration for the module can be confirmed only once a synopsis and programme of proposed study has been accepted by the module leader. Students' progress is closely monitored - supervisors and students being expected to meet for approximately 1 hour per week.

The student is expected to plan and execute the research report on their own initiative.

Assessment: Research dissertation and presentation (100%).

DP Requirement: None

Simulated Office Project

ENCS7SO H2   (40L-0T-0P-0S-80H-0R-0F-120G-80A-15W-32C)

Prerequisite: ENCS7CE and ENCS7PF
Aim: To integrate theoretical study of procurement management in terms of a multi-disciplinary based project representing typical conditions of professional practice. .
Content: Students 'practice' as a quantity surveying consultancy. Each group is allocated a project. Professional teams interact with client bodies in the formulation of a project brief, the establishment of budget limitations and the ascertainment of project time considerations and produce a detailed project appraisal report. Quantity surveying 'firms' to provide a full service.
Assessment: Major assignment and presentation (100%). No supplementary examination.
DP Requirement: None

Management of Construction Contracts

ENPD7CL H2 (26L-6T-6P-0S-31H-6R-0F-0G-5A-13W-8C)
Prerequisite Requirement: Only students registered in the 4th year of study permitted to undertake this module.
Aim: To expose students to forms of contract adopted internationally, as well as statutes governing Occupational Health and Safety standards within the built environment in South Africa.
Content: International Construction Contracts; Primary legal principles adopted in construction contracts; Occupational Health and Safety legislation in South Africa.
Assessment: Assignments (40%); 2 h exam (60%). Engineering students are required to show competence in ECSA Outcomes 7 & 10 relevant to this module.
DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Professional Practice

ENPD7PP H1 (26L-6T-6P-0S-31H-6R-0F-0G-5A-13W-8C)
Prerequisite Requirement: Only students registered in the 4th year of study permitted to undertake this module.
Aim: To expose students to the statutes governing the property/construction industry professions - with the specific objective of preparing them for the establishment and development of a professional practice. Introduce students to the complexity of modern professional office administration and practice management.
Content: Structuring the professional practice and contractual agreements; marketing the practice; legislation governing professional practice; practice administration and management; financial management; tax planning; insurances; elements of social interactions/interpersonal communication.
Assessment: Assignments (40%); 3 h exam (60%). Engineering students are required to show competence in ECSA Outcomes 8 & 10 relevant to this module.
DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

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Land Surveying

Offered in the School of Engineering

Geomatics I

ENSV1G1 H1 (28L-10T-19P-0S-68H-30R-0F-0G-5A-13W-16C)
Aim: To introduce the scope and uses of spatially referenced information and methods of acquiring it, at local and global scales. To introduce the concept of data quality and ways of assessing it. To introduce ways of representing spatial data in different reference systems of the 3-dimensional Earth and on various map projections, and transformation of information between reference systems.
Content: An overview of the concepts of geomatics; the nature of spatial data; representation of spatial data; co-ordinate systems and the standard map projection systems used in South Africa (Gauss, Conformal, Lambert's, Conical, Conformal and Alber's Equal Area); overview of the methods of acquisition of spatial data; processing, analysis, representation and display of spatial data; introduction to statistical description and analysis of spatial data;

introduction to the concepts of geographical information systems (GIS); interpretation and analysis of maps, aerial photographs and remote sensing imagery.

Practicals: Field and office work on data acquisition, processing and presentation.

Assessment: Class mark (30%); 3 h exam (70%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Geomatics 2

ENSV1G2 H2   (28L-10T-19P-0S-68H-30R-0F-0G-5A-13W-16C)

Prerequisite Requirement: 40% in ENSV1G1.

Aim: To provide students with an ability to plan and carry out a survey of any mapping and/or engineering project, and to select the right methodology, equipment and software to facilitate processing and presentation of the survey results in an appropriate and easy to understand format.

Content: Levelling; angle measurement; distance measurement; methods for fixing ground control and observation points; site and field surveying; Similarity and affine co-ordinate transformations; GPS for use in Geographic Information Systems (GIS); theory and application of a gyrotheodolite.

Practicals: Field and office work on data acquisition, processing and presentation.

Assessment: Class mark (30%); 3 h exam (70%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Introduction to Geomorphology

ENSV1GM H1   (14L-6T-10P-0S-35H-10R-0F-0G-5A-13W-8C)

Aim: To enable students to understand land surface evolution & the natural environment and to have a background on the associated natural environmental hazards and how these affect the geodetic reference frames.

Content: Introduction to land surface formation, geological time, the major rock groups & their characteristics. Introduction to plate tectonics, crustal deformation and its effect on Geodetic Reference Frames. Surface faults, stresses and strain. Introduction to natural environmental hazards including earthquakes, tsunamis, landslides, floods and fires and their impact on spatial referencing networks. Introduction to natural hazard and risk zonation maps and their characterization.

Assessment: Assignments/Practicals and Tests (30%); 2 h exam (70%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Cadastral Surveying 1

ENSV2CS H1   (20L-10T-40P-0S-70H-15R-0F-0G-5A-13W-16C)

Aim: To enable students to carry out the surveying, computational and presentation phases of a minor subdivision, to advise a client on the requirements and submission process, to understand the relevant legislation.

Content: The need for cadastral survey and registration; the South African cadastral system; conveyancing; ownership; rights in land; subdivisional application; details of the Land Survey Act and regulations; Professional Land Surveyors and Technical Surveyors Act and Rules; software packages for fieldwork and computations; cadastral survey task.

Practicals: Field work on relocation of boundaries, subdivision.

Assessment: Practical assignments and one test (30%); 3 h exam (70%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Hydrographic Surveying

ENSV2HY H1   (28L-10T-19P-0S-68H-30R-0F-0G-5A-13W-16C)

Aim: To provide students with an ability to plan and carry out a near shore bathymetric survey using total stations, real time differential GPS and digital echo sounder, reduce the results and produce a contoured chart of the area.

Content: Maritime baselines, boundaries, limits and coastal rights; Control for inshore and offshore position fixing; Acoustic ranging systems; Depth determination, depth data, underwater acoustics; Tidal regime, wave heights, mean sea level and chart datum transfer; Harmonic components, tidal constituents; Wave refraction, reflection and diffraction; CSP principles. Satellite altimetry and its application to ocean bathymetry; Secular variations in MSL and their relevance to climate. Positional control of robotic hydrographic exploration; Geophysical exploration of the oceanic subsurface.
Practicals: Methods used in hydrographic surveying.
Assessment: Practical/tutorial assignment (15%); 3 h exam (85%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Survey Camp 2
ENSV2SC H2   (0L-0T-0P-0S-0H-0R-80F-0G-0A-2W-8C)
Prerequisite Modules: ENSV1G1
Aim: To introduce students to the establishment of low order control for use by more junior candidates undertaking DNS1SC2. Advise more junior candidates on techniques, data management and graphics.
Content: The topic consists of completing assigned tasks that vary from year to year. These generally do not take the candidate beyond what was learned formally in Second Year modules but consolidate understanding and skill in the various stages involved in spatial information gathering and presentation.
Practicals: This module is carried out as a practical exercise off-campus, often in a nature reserve.
Assessment: Daily assessment of performance in the field and compilation of a portfolio of daily activities (100%).
DP Requirement: 100% attendance.
This module has no supplementary exam.

Layout Design
ENSV2LY H1   (30L-20T-32P-0S-53H-10R-0F-0G-15A-13W-16C)
Aim: To enable students to have an understanding of the technical principles, procedures and methods of design in the built environment, and their implementation in their eventual practice as Land Surveyors.
Content: Introduction to the built environment, the built form, urban design theory, Sustainability. Urbanization and housing delivery, Housing delivery systems and design, Land Use Management systems and Development Control, Project Implementation, Site Analysis, GIS and CAD in layout design, Planning Standards and Criteria, Infrastructure and Design Systems.
Practicals: Two site visits to a brownfield redevelopment site. Practical design project work.
Assessment: Assignments (10%), tests (10%), project work (30%); 3 h exam (50%).
DP Requirement: 80% attendance at practicals, 50% class mark.

Surveying Engineering
ENSV2SE H1   (28L-10T-19P-0S-68H-30R-0F-0G-5A-13W-16C)
Aim: To introduce students to the concepts of observing, recording, reduction and presentation of survey measurements and their applications in engineering projects and to highlight the importance of recognising landownership when executing engineering projects.
Content: The nature and representation of spatial data; co-ordinate systems and map projection systems used in South Africa; overview of modern surveying instruments for spatial data acquisition; levelling; angle measurement; distance measurement; methods for fixing ground control and observation points; site surveying and terrain modelling; photo interpretation; introduction to Geographical Introduction Systems (GIS); Introduction to Global Position System (GPS); engineering applications of survey measurements; introduction to cadastral surveys and landownership.
Practicals: Field and office work involving various survey techniques, processing and presentation of survey measurements.
Assessment: Class mark (30%); 3 h exam (70%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Spatial Modelling and Visualisation
ENSV2SV   39L-5T-52P-0S-26H-15R-0F-0G-5A-15W-16C
Pre-requisite Modules: ENSV1G2 and MATH132
Co-requisite: PHYS251
Aim: To enable students to have an understanding of engineering surveying, close-range photogrammetry, virtual models, cartography and spatial visualisation and their implementation and relevance in the students eventual practice as land surveyors.
Content: Site surveying; coordinates of intersecting lines; Introduction to GNSS; introduction to circular and transition curves; vertical curves; construction surveying; laser scanning systems; close-range photogrammetry; virtual models; site documentation.
Practicals: The students will undertake field practicals on various aspects of survey measurements.
Assessment: Assignments, Practicals and Tests (30%) and one 3-hour exam (70%).
DP Requirement: Completion and submission of all assignments on time and compliance with the attendance requirements of the school.

Theory of Adjustments 1
ENSV2T1 H1   (40L-10T-0P-0S-70H-35R-0F-0G-5A-13W-16C)
Prerequisite Modules: MATH131.
Aim: To show students difference statistical techniques required for analysis of quantitative data and how to measure and control data quality, to form simple linear functional models, how to form linear functional models of simple problems and solve them using the least-squares method.
Content: The nature of data. Measures of central tendency and dispersion. Basic Probability concepts. Estimation. Introduction to statistical inference. Hypothesis tests on the Normal, Student - T, and Chi Squared distributions for population parameters of both one and two populations. Confidence limits. Multivariate continuous distributions. Correlation and regression. Error propagation. An introduction to least squares adjustments; adjustment of indirect observations; numerical considerations in adjustments; *a posteriori* statistical analysis. Applications of adjustments.
Assessment: Class mark (30%); 3 h exam (70%).
DP Requirement: Students are required to hand in 40% of assignments.

Theory of Adjustments 2
ENSV2T2 H2   (28L-10T-0P-0S-67H-50R-0F-0G-5A-13W-16C)
Aim: To provide students with an understanding and skills in formulating and solving advanced adjustment problems and quality assessments.
Content: Least squares adjustments with constraints; general case of least squares; partitioning of least squares problems and Helmert blocking; sequential least squares and Kalman filtering; concepts of reliability; detection of outliers; analysis of surveying networks; the datum problem; free networks.
Assessment: Tests (15%), tutorials (15%); 3 h exam (70%).
DP Requirement: Hand in 40% of assignments and attend one test.

Co-ordinate Systems & Geodetic Projections
ENSV3CG H2   (40L-0T-20P-0S-60H-35R-0F-0G-5A-13W-16C)
Aim: To enable students to transform positions on a plane or three-dimensional system, to solve problems on the unit sphere, to understand common 3-dimensional systems, to transform onto and from the ellipsoid to the Gauss conformal projection.
Content: Rotations in three dimensions; spherical trigonometry; co-ordinate transformations; Local and global natural and conventional co-ordinate systems for the Earth; the Laplace condition; geometry of the ellipsoid; calculation of coordinates in three dimensions and on the reference ellipsoid; Gauss conformal projection; astronomical co-ordinate systems and time systems.
Practicals: Hands-on experience in solving problems and geodetic projections.
Assessment: Tutorial Assignments and one test (30%); 3 h exam (70%).

DP Requirement: Students are required to attend all lectures and complete all practicals and assignments satisfactorily, as specified in the module outline.

Cadastral Surveying 2

ENSV3CS H2   (40L-0T-20P-0S-60H-35R-0F-0G-5A-13W-16C)

Aim: To enable the student to carry out the geometrical design and create a general plan of a township layout, to. survey a sectional title scheme, to plan a development route for a township scheme.

Content: Cadastral systems; rectilinear boundaries; acquisition of land; registration and certificates of titles; servitudes; leases; curvilinear boundaries; township development; town survey marks; sectional titles; application of computer aided drafting; cadastral surveying task.

Practicals: Hands-on experience in cadastral surveying.

Assessment: Practical assignments, one test (30%); 3 h exam (70%).

DP Requirement: Students are required to attend all lectures and complete all practicals and assignments satisfactorily, as specified in the module outline.

Photogrammetry

ENSV3PO H1   (28L-10T-19P-0S-83H-15R-0F-0G-5A-13W-16C)

Aim: To enable the student to design a photogrammetric project, determine if photogrammetric methods will solve a problem, analyse the results of a photogrammetric project.

Content: Introduction to photogrammetry, basic mathematics of photogrammetry, photogrammetric optics, aerial cameras and photography, aerotriangulation, control surveys, analogue, analytical and digital plotting instruments, orthophotographs, planning and executing a photogrammetric project, non-topographic photogrammetry. Application areas.

Practicals: Design and implementation of a photogrammetric project.

Assessment: Tutorial/Practical Assignments and one test (30%); 3 h exam (70%).

DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Survey Camp 3

ENSV3SC H2   (0L-0T-0P-0S-0H-0R-80F-0G-0A-2W-8C)

Prerequisite Modules: ENSV2SC.

Aim: To enable students to establish first-order control, to organise data storage, integrity and long-term accessibility, to prepare final graphic output of field data.

Content: The topic consists of completing assigned tasks that vary from year to year. These generally do not take the student beyond what was learned formally in second and third year modules but consolidate understanding and skill in the various stages involved in spatial information gathering and presentation.

Practicals: This module is carried out as a practical exercise off-campus, often in a nature reserve.

Assessment: Daily assessment of performance in the field and compilation of a portfolio of daily activities (100%).

DP Requirement: 100% attendance.

This module has no supplementary exam. Daily assessment of performance in the field, alternatively a portfolio presentation.

Engineering Surveying 2

ENSV3SE H1   (28L-10T-19P-0S-78H-20R-0F-0G-5A-13W-16C)

Prerequisite Modules: ENSV2T2

Aim: To enable students to design an appropriate measuring, execution and analysis scheme for an engineering surveying problem, and analyse the results.

Content: Horizontal circular curves, horizontal transitional curves, vertical symmetrical curves, vertical unsymmetrical curves. Terrestrial Laser scanning. Network adjustment techniques. Accuracy assessment of survey measurement; Introduction to deformation and monitoring techniques and models. Statistical analysis and identification of distortions. Robust techniques.

Practicals: Practicals are done on campus. Students may be taken to the sites off campus if need arises.
Assessment: Assignments/Practicals and Tests (30%); 3 h exam (70%).
DP Requirement: DP Requirement: Students are required to attend tutorials/lectures and complete practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Satellite Surveying

ENSV3SS H2   (28L-10T-19P-0S-68H-30R-0F-0G-5A-13W-16C)
Aim: To enable students to perform GPS surveys efficiently, assess their quality, assess hidden errors, specify equipment needs. To introduce students to the instrumentation and techniques used in realisation of global reference, enabling the student to integrate these systems into national and regional projects.
Content: Satellite co-ordinate systems and satellite orbits, principles of position location using satellites. The Global Position System; navigation and surveying using GPS. Design a control system for a specific geodetic task.
Practicals: Perform GPS surveys.
Assessment: Tutorial/Practical assignments and one test (30%); 3 h exam (70%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Geodesy

ENSV4GY H1   (30L-20T-0P-0S-75H-30R-0F-0G-5A-13W-16C)
Aim: To give students an understanding of the Earth's gravity field as it affects measurements on it, the various models for height and gravity reductions and representational frameworks.
Content: Potential theory, gravity observations, reductions and instruments, isostacy, height systems, 3-dimensional triangulation; geodetic co-ordinate systems. Geodetic surveying in one dimension (geodetic levelling and gravimetry), in two dimensions (geodetic astronomy and two-dimensional geodetic networks) and in three dimensions: threedimensional geodetic networks, inertial surveying systems, geodetic use of the Global Position System, very long baseline interferometry, lunar and satellite laser ranging, satellite and airborne gravity gradiometry, satellite altimetry.
Assessment: Tutorial assignments and one test (30%); 3 h exam (70%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all assignments and tutorials satisfactorily, as specified in the module outline.

Precise Engineering Surveying

ENSV4PE H2   (28L-10T-19P-0S-78H-20R-0F-0G-5A-13W-16C)
Prerequisite Modules: ENSV2SV and ENSV2T2.
Aim: To enable students to: calibrate precise measuring instruments, design an appropriate measuring scheme for a specific problem, subject real observations to appropriate analysis.
Content: Precise Geodetic surveys; Instrumentation used in precise engineering surveying; testing and laboratory calibration of instruments; precision surveying methods; including methods of precision alignment, deformation surveys, analytical methods associated with precision engineering surveys, pre-and post-analyses of accuracy. Unified adjustment techniques, sequential processing, interpolation, filtering, collocation and real-time data analysis.
Assessment: Assignments/Practicals (15%), test (15%); 3 h exam (70%).
DP Requirement: Students are required to attend tutorials/lectures and complete practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Planning Law

ENSV4PL H1   (26L-0T-0P-4S-20H-10R-0F-0G-20A-13W-8C)
Prerequisite Modules: LAWS2PR.
Aim: To enable students to develop an understanding of & application of planning law regulations, and their implementation and relevance in their practice as Land Surveyors.
Content: Introduction to planning law. Overview of planning law. Ingonyama Trust Act. Lands Act. Tenure rights. Emerging tenure in informal settlements. National Environmental Management Act (NEMA). Biodiversity Act. Environmental management frameworks. Water Act. Sustainable Waste Management Act. Provincial PDA. Township

establishment procedures, schemes, special consents, rezoning. Land use change. Housing Act. Rental Act. Social Housing Act. Sectional Titles Act. Application of laws & surveying responsibilities in a project.
Assessment: Assignments (20%), Tests (20%); 3 h exam (60%).
DP Requirement: 40% Class Mark and 100% attendance at tests.

Photogrammetry 2
ENSV4PO H2   (28L-10T-19P-0S-78H-20R-0F-0G-5A-13W-16C)
Prerequisite Modules: ENSV2T2 and ENSV3PO.
Aim: To enable students to: undertake close range photogrammetry and LIDAR mapping, design an appropriate measuring scheme for close range photogrammery, to subject real observations to appropriate analysis.
Content: Close range photogrammetric cameras. Non-metric digital camera calibration. Control for close range photogrammetry. Analytical methods associated with close range photogrammetry. Bundle adjustment techniques. Panoramas. LIDAR acquisition platforms, data products and applications. Pre-and post-analyses of accuracies. Visualisation and integration of such data products into GIS.
Practicals: Practicals are done on campus. Students may be taken to the sites off campus if need arises.
Assessment: Assignments/Practicals and Tests (30%); 3 h exam (70%).
DP Requirement: Students are required to attend tutorials/lectures and complete practicals, assignments and tutorials satisfactorily, as specified in the module outline.

Research Methodology
ENSV4RM H1   (14L-9T-0P-0S-57H-0R-0F-0G-0A-13W-8C)
Aim: To enable the student to produce quality hard-copy and presentation material, to make a professional presentation, to write a project proposal, use library and source reference material and to use approved referencing.
Content: Primary factors of research activity in support of ENSV4SP. Topics include: What is research? Selecting and justifying a research topic. Planning research project. Literature search, data analysis and gathering. Presentation of findings.
Assessment: A written mini-project proposal (30%), written full project proposal and an oral presentation (70%).
DP Requirement: 40% for mini-project proposal.
This module has no supplementary exam.

Surveying & Mapping Project
ENSV4SP H2   (10L-40T-0P-0S-270H-0R-0F-0G-0A-13W-32C)
Prerequisite Requirement: 40% for ENSV4RM.
Aim: To enable the student to carry out a substantial self-leaning exercise involving data collection, analysis, presentation of a mini-dissertation and an oral presentation.
Content: The candidate is invited to choose his/her own topic for investigation. The topic should be relevant to the broad field of geomatics and preferably it should develop knowledge and skill in some aspect that the candidate wishes to develop further after graduating.
Assessment: Mini-dissertation, oral presentation and participation in a seminar (100%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Land Tenure
ENSV4TN H1   (39L-0T-0P-15S-71H-30R-0F-0G-5A-13W-16C)
Aim: To enable the student to understand the role of security of tenure and land ownership in the land survey profession in order to be informed of the right approach to solving cadastral and land management problems.
Content: Introductory land tenure concepts; world land tenure systems; historical development of land tenure patterns in South Africa; Land policies of the South African Government of National Unity; South African Land Tenure Systems; Cadastral systems and Cadastral reform.
Practicals: Essay assignments and seminar/s on approaches to solve cadastral, tenure and land management problems.

Assessment: Class mark (30%); 3 h exam (70%).
DP Requirement: Students are required to attend all tutorials/lectures and complete all assignments and tutorials satisfactorily, as specified in the module outline.
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Engineering Access Programme

Augmented Engineering Design
ENAG160 H2   (20L-20T-0P-0S-20H-0R-0F-0G-18A-13W-8DC-8FC)
Aim: To develop the ability to configure an appropriate design process and to select appropriate materials and manufacturing processes to carry out the construction and testing of a simple device.
Content: Philosophy of design process: problem definition, implementation, evaluation, time and project management and safety. Software tools for problem solving and engineering analysis: MATLAB (introduction to MATLAB and basic programming).
Practicals: Students spend time constructing and testing small engineering systems in class and around the campus.
Assessment: Year Mark (30% of final mark), Assignments and projects (50%), 2 class tests (30%), Practical test (20%), Exam (70% of final mark), One 2-hr exam
DP Requirement: 1. Students must write both class tests. All students who fail the class test will be required to attend a session with the faculty Academic Development Officer (ODA). Failure to attend this session will imply a DP refusal.

2. Students must obtain a minimum of 40% in the MATLAB practical test.

3. Students must obtain a minimum of 40% in the Irrigation Experiment.

4. As a team member, students must construct a steam car.

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Augmented Engineering Mathematics 1A
MATH160 HY   (78L-78T-72P-0S-99H-54R-0F-0G-11A-30W-16DC-16FC)
Aim: To introduce basic mathematical concepts of functions, limits, differential and integral calculus.
Content: Basic arithmetic, functions and their graphs, limits and continuity, differentiation, application of derivatives to optimization and curve sketching, linear and quadratic approximation, inverse trigonometric and other transcendental functions, indeterminate forms, indefinite integrals, basic techniques of integration, definite integrals, application in geometry, physics, and engineering.
Assessment: Class Mark: (class tests, quizzes, tutorial tests and assignments) (50%); 3h exam (50%).
DP Requirement: 40% class mark, 80% attendance at lectures and 80% completion of tutorial requirements.

Aumented Engineering Physics 1B
PHYS163 HY   (78L-26T-72P-0S-73H-60R-0F-0G-11A-30W-16DC-16FC)
Pre-requisite requirement: 40% in PHYS160; 40% in MATH160.
Co-requisite module: MATH161
Aim: To gain understanding of, & ability to apply, thermodynamics, electricity & magnetism, geometrical optics & atomic physics at an introductory level. This is a calculus-based module.
Content: This module is only for students in the Engineering Access Programme. It covers the syllabus of PHYS152 but, in addition, includes a substantial amount of supplementary material and tuition designed for students who are under-prepared for university-level studies to a maximum of 160 Hours.
Assessment: Tests/Assignments (30%), practical reports (20%); 3 hr theory exam (50%).
DP Requirement: Class mark of 40%, Attendance at 80% of lectures, tutorials and practicals 100% attendance at all assessments.

Augmented Engineering Physics 1A
PHYS160 HY   (78L-26T-72P-0S-73H-60R-0F-0G-11A-30W-16DC-16FC)
Co-requisite module: MATH160

Aim: Introduction to, and an ability to apply, mechanics, oscillations and thermal physics at an introductory level. This is a calculus-based module.

Content: This module is only for students in the Engineering Access Programme. It covers the syllabus of PHYS151 but, in addition, includes a substantial amount of supplementary material and tuition designed for students who are under-prepared for university-level studies to a maximum of 160 Hours.

Assessment: Tests/Assignments (30%), practical reports (20%); 3 hr theory exam (50%).

DP Requirement: Class mark of 40%, Attendance at 80% of lectures, tutorials and practicals 100% attendance at all assessments.

Augmented Engineering Materials

ENAG161 H2 (29L-20T-0P-0S-20H-5R-0F-0G-6A-13W-8DC-8FC)

Aim: Acquire a basic understanding of materials, their structure and its influence on the physical and mechanical properties; crystallographic structures, defects in these structures and how this influences the mechanical properties; the mechanical properties of materials; and phase diagrams and how microstructures are formed.

Content: Introduction to materials, structure of materials, crystal imperfections, mechanical behaviour of materials, alloys and properties of alloys, equilibrium phase diagrams.

Assessment: Class mark: 40% (tests, assignments, tutorial tests and quizzes); 2h exam: 60%.

DP Requirement: 40% class mark, 80% attendance at lectures and 80% completion of tutorial requirements.

Augmented Technical Communication for Engineers

ENCH160 H1 (10L-15T-0P-13S-20H-16R-0F-0G-6A-13W-8DC-8FC)

Aim: To develop students' discourse competence in Technical English with the intention of improving their ability to read a range of texts, to write genres important to Engineering students, and to give oral presentations on Engineering topics

.**Content:** Course content is short research projects relating to Engineering. Technical Communication for Engineers is a practical course in which students improve their writing through practical experience of a number of different kinds of writing: Design Reports, Technical Reports, and seminar papers. Through the process of short research projects relating to Engineering, students will be supported in their reading in order to improve their ability to extract meaning from Engineering-related texts taken from a range of genres, (from news articles to textbooks and simple research articles) and to use these sources appropriately in writing their own texts in the appropriate academic register. In addition students gain experience in presenting a short talk.

Assessment: Seminar paper 10%, Technical report (design) 25%, Technical report (research) 15%, Test 30%, Oral presentation 20%

DP Requirement: Continuously assessed module, No examination, No supplementary examination.

Augmented Engineering Drawing

ENME160 H1 (14L-26T-0P-0S-20H-12R-0F-0G-9A-13W-8DC-8FC)

Aim: To provide students with basic information and skills to be able to read and understand drawings as a language for engineering communication and explain the fundamental principles of projection and drawing practice.

Content: Geometrical constructions. Isometric projections (pictorial representation). 1st and 3rd Angle Orthographic Projection, including hidden detail, dimensioning, theory of sectional and auxiliary views, and conventional representations. Interpenetrations and developments. Applying these concepts in Computer Aided Drawing (CAD) software tool.

Assessment: Drawings: Tutorials and tests - 25%, CAD: Tutorials and test - 75%, Final mark: 50% of Classmark & 50% of Final Exam.

DP Requirement: Attendance at all tests, 50% for the CAD component.

Augmented Engineering Mathematics 1B

MATH161 H0 (78L-20T-0P-0S-47H-10R-0F-0G-11A-26W-16DC-16FC)

Aim: To develop concepts of differential and integral calculus and introduce elements of differential equations and complex numbers.

Content: Further techniques of integration, improper integrals, further applications of integration, sequences and series, Taylor expansion, conic sections, polar coordinates, basic differential equations, complex numbers and basic complex functions.

Assessment: Class Mark: (class tests, quizzes, tutorial tests and assignments) (50%); 3h exam (50%).

DP Requirement: 40% class mark, 80% attendance at lectures and 80% completion of tutorial requirements.

Environmental Sciences

Offered in the School of Agricultural, Earth and Environmental Sciences

Environmental Systems

ENVS120 H2 P2 W2   (39L-8T-30P-0S-66H-10R-0F-0G-7A-13W-16C)

Aim: To introduce basic concepts in Physical Geography & the functioning of Environmental Systems.

Content: An integrated, process-related, systems approach to studying the earth & its spatial variability. Atmosphere – the structure & composition of the atmosphere & human influence on it; weather & climate. Biosphere – basic ecological concepts pertinent to populations, communities & ecosystems. Hydrosphere – the hydrological cycle, transport by running water, coastal processes. Lithosphere – broad-scale lithospheric processes; the composition & dynamics of the earth's crustal system. Cartographic theory & map skills are taught as an integral component of the module.

Assessment: Tests (30%), practicals (20%); 3 h exam (50%).

Subminimum: 40% on exam.

DP Requirement: Not applicable

Students may be required to contribute to costs of fieldwork.

This module is only available to students registered for the BSS – GEM programme or Geography as a major.

Biophysical Environments of Southern Africa

ENVS210 H1 P1 W1   (39L-0T-40P-0S-54H-20R-0F-0G-7A-13W-16C)

Prerequisite Modules: ENVS120.

Aim: To introduce students to the physical processes that shape the biophysical environment in southern Africa.

Content: Weather producing systems and southern African climates and their variability; the biogeography of the region in terms of the distribution of biota through climatic and other environmental factors; a discussion of biomes, biodiversity and conservation; the properties of geomorphic materials as well as erosion, transport and deposition processes that shape and modify the landscape.

Assessment: Tests (30%), practicals (20%); 3 h exam (50%).

Subminimum: 40% on exam

DP Requirement: Not applicable.

Students may be required to contribute to costs of fieldwork.

Only for students majoring in GEOG/ENVS or an appropriate programme with the module as core.

Geographic Information Systems

ENVS211 H2 P2 W2   (29L-0T-36P-0S-77H-10R-0F-0G-8A-13W-16C)

Prerequisite Requirement: GEOG110 and ENVS120 or 64C from SAEES, SLS or School of Engineering.

Aim: To introduce students to the concepts, techniques and interdisciplinary application of GIS and remote sensing as environmental decision-making tools.

Content: Development, interdisciplinary nature and potential value of GIS; referencing the geographic location of data; technological environment of GIS, data sources, data models, entry and analysis; data quality, management & legal

aspects; GPS, spatial representation concepts, maps as records and reflections of dominant ideologies, introduction to aerial photography.

Assessment: Practical reports (15%), Practical test (15%), theory test (20%); 3 h exam (50%). Subminimum: 40% on exam

DP Requirement: Not applicable

This module is only for students that are registered for a major or programme in which this module is specifically listed as core.

Introduction to Remote Sensing

ENVS250 P1   (29L-0T-36P-0S-75H-10R-0F-0G-10A-13W-16C)

Prerequisite Module: GEOG110 and ENVS120 or 64C from Schools of Agriculture, Earth & Environmental Sciences, Life Sciences or Engineering

Aim: To introduce the theoretical and practical concepts of Remote Sensing.

Content: Principles of Remote Sensing. Sensor characteristics. Field Observations. Data gathering and quality assurance. Forms of Remote Sensing, Digital image data processing. Image classification. Environmental applications of remote sensing.

Assessment: Test (20%), practical reports (15 %), Practical test (15 %); 3 h theory exam (50%).

Subminimum: 40% on exam.

DP Requirement: Not applicable

Biogeography and Climatic Change

ENVS314 P1 W2   (27L-5T-30P-6S-64H-24R-0F-0G-4A-13W-16C)

Prerequisite Modules: ENVS210.

Aim: To provide students with a broad understanding of key biogeographical concepts.

Content: Process, pattern and scale in biogeography. Biogeographical regions. Distributional patterns and the roles of climate and evolution. Palaeo-climatic change. Biological processes in biogeography: adaptation; speciation; extinction; ecological interactions. Biogeographical reconstruction: refugia, evolutionary biogeography. Measures of range size.

Species-area curves.

Assessment: Tests (15%), Seminar, essays, presentations (20%), Practicals (15%); 3 h exam (50%). Subminimum: 40% on exam.

DP Requirement: Not applicable

Students may be required to contribute to costs of fieldwork.

This module is only for students that are registered for a major or programme in which this module is specifically listed as core.

Soil Erosion and Land Degradation

ENVS315 P1 H1 W1   (27L-0T-46P-0S-73H-10R-0F-0G-4A-13W-16C)

Prerequisite Modules: ENVS210

Aim: To introduce the processes, social & physical consequences of soil erosion & land degradation issues in Africa.

Content: Land degradation & sustainability; causes & consequences of degradation; risk assessment in relation to the sustainability of soil; food security & degradation; political & socio-economic aspects of soil erosion; physical & chemical erosion processes; human-environment processes & influences; conservation practices; magnitude-frequency considerations; desertification; land use systems in a historical context; soil conservation strategies; principles, planning & policy issues.

Practicals: Case studies & applications. Possible four day excursion.

Assessment: Field report (15%), Practicals (15%), Test (20%); 3 h exam (50%).

Subminimum: 40% on exam.

DP Requirement: Not applicable

Students may be required to contribute to costs of fieldwork.

This module is only for students that are registered for a major or programme in which this module is specifically listed as core.

GIS & Remote Sensing

ENVS316 H1 P1 W1   (27L-1T-36P-0S-62H-27R-0F-0G-7A-13W-16C)

Prerequisite Modules: 64 Credits from AES at level 2 including ENVS211

Aim: To provide further insight into GIS as a management tool for spatial data.

Content: Spatial data and modelling; attribute data management; analysis of remotely sensed GIS data and its classification; data quality issues; GIS project management and design.

Assessment: Test (20%), practical reports (15%), practical test (15%); 3 h theory exam (50%).

Subminimum: 40% on exam.

DP Requirement: Not applicable

Students may be required to contribute to costs of fieldwork.

This module is only for students that are registered for a major or programme in which this module is specifically listed as core.

Global Environmental Change

ENVS319 P2   (27L-5T-30P-0S-72H-16R-0F-0G-10A-13W-16C)

Prerequisite Modules: ENVS210.

Aim: To provide students with a broad understanding of global environmental change through geological history and into the future.

Content: Process, pattern and scale in environmental change. Understanding natural climatic variability. Environmental change during the Quaternary Period. The use of palaeodating techniques and proxy records for elucidating past climates and environments. The IPCC Assessment Reports and projections for the future. Climate change uncertainties and the scenario approach.

Assessment: Tests (20%), oral and written assignments (15%), practicals (including a field trip) (25%); 3 h exam (50%).

Subminimum: 40% on exam.

DP Requirement: Not applicable

Students may be required to contribute to costs of fieldwork.

This module is only for students that are registered for a major or programme in which this module is specifically listed as core.

Environmental Management

ENVS322 H2 P2 W2   (27L-0T-36P-8S-65H-20R-0F-0G-4A-13W-16C)

Prerequisite Modules: ENVS210 Note: This module is a capstone module and may only be taken in the final (completing) year of the degree.

Aim: To develop an understanding of environmental management theory and practice.

Content: Theoretical and critical examination of the issues of environmental management by examining the history of environmentalism and mainstream approaches and their alternatives. The relationship between environment and planning; examination of the different tools and methods used in environmental management.

Practicals: Use of methods and techniques related to environmental management tools.

Assessment: Essays/Assignments (15%), tests (20%), practicals/tutorials (15%); 3 h exam (50%).

Subminimum: 40% on exam.

DP Requirement: Not applicable

Students may be required to contribute to costs of fieldwork.

This module is only for students that are registered for a major or programme in which this module is specifically listed as core.

Geospatial Data Infrastructures

ENVS350 P1 W1   (29L-0T-36P-0S-75H-10R-0F-0G-10A-13W-16C)

Prerequisite Modules: ENVS211.

Aim: To provide an in-depth theoretical and practical understanding of Geospatial Data Infrastructures (GDI's).

Content: Justification for GDI's. GDI policy framework. Technology issues for GDI development and implementation. GDI case studies.

Assessment: Assignments and tests (30%), practical reports (20%); 3 h exam (50%).

Subminimum: 40% on exam.

DP Requirement: Not applicable

This module is only for students that are registered for a major or programme in which this module is specifically listed as core.

Applied Environmental GIS & Remote Sensing

ENVS360 P1   (29L-0T-36P-0S-75H-10R-0F-0G-10A-13W-16C)

Prerequisite Modules: ENVS211.

Aim: To provide students with in-depth and diverse theoretical and practical applications of GIS and remote sensing.

Content: Image processing, image transformation and analysis, GIS and Remote sensing integration. Taxonomy & uncertainty, scale issues. GIS and image data fusion. Applications in agriculture, water resource management, ecology, forestry, urban landscapes, geology, soils.

Assessment: Assignments and tests (20%), practical (30%); 3 h theory exam (50%).

Subminimum: 40% on exam.

DP Requirement: Not applicable

This module is only available to students registered for the BSS – GEM programme or Geography as a major

Research in the Environmental Sciences

ENVS390 W2   (15L-23T-12P-0S-72H-10R-0F-25G-3A-13W-16C)

Prerequisite Requirement: At least 64 credits at level 2 from disciplines allied to the environmental sciences field. Note: Only offered for students majoring in Geography (BSc) or an appropriate BSc programme with the module as core.

Aim: To integrate knowledge derived in the course of their degree and to develop independent research skills.

Content: Science philosophy, introduction to various approaches to research, statistical analysis and academic writing. Conception, design and writing of a small research proposal.

Assessment: Essays (20%), Assignments/Practicals (20%), Project proposal (10%), 3hr theory exam (50%)

DP Requirement: Not applicable.

Only for students registered in BSc Geography or other BSc programme with the module as core.

Subminimum: 40% on exam

This module is only for students that are registered for a major or programme in which this module is specifically listed as core.

Research Methods in Environmental Sciences

ENVS700 P1 W1   (30L-0T-8P-0S-99H-20R-0F-0G-3A-13W-16C)

Prerequisite Requirement: Entry into an appropriate Honours programme.

Aim: To introduce students to the history and philosophy of science and to develop techniques and skills in scientific research methods in the environmental sciences, which are relevant to solving current and past the environmental problems.

Content: The history and philosophy of science; the production of knowledge in the environmental sciences, techniques and skills such as basic survey and measurement in the natural sciences; statistical analysis and procedures, and other vital natural science skills. The preparation of a scientific paper and its oral and written presentation.

Assessment: Term paper (25%), Essays, presentations, seminars (15%), assignment (10%); 3 h exam (50%).

Subminimum: 40% on exam.

DP Requirement: Not applicable

Biogeography of Invasive Species

ENVS708 WC   (20L-0T-14P-15S-78H-30R-0F-3G-0A-13W-16C)

Prerequisite Requirement: ENVS314 or a completed major in BIOL.

Aim: To provide a solid understanding of the biogeographical and ecological patterns and processes associated with invasive species.

Content: Definitions: naturalization, invasiveness, invisibility of species. Natural versus human-assisted changes in species distributions. Plant invasions and biological control. Freshwater animal invasions. Marine invasions. Island versus mainland invasions. Mapping and modelling the spread of invasive species. Invasion phylogenetics. Assessing invasive species as threats to indigenous biodiversity.

Assessment: Seminars (30%), practicals (20%); 3 h exam (50%).

Subminimum: 40% on exam.

DP Requirement: Not applicable

Offered in either Semester 1 or 2. Students may be required to contribute to the costs of the fieldtrip.

Advanced Global Change

ENVS709 P2   (0L-0T-31P-36S-50H-30R-0F-0G-13A-13W-16C)

Prerequisite Requirement: 60% in ENVS319.

Aim: To discuss, critically evaluate, synthesise and integrate approaches and quantitative techniques used to understand environmental change in the global and southern African contexts.

Content: Uncertainty surrounding reconstructions, models & predictions; Natural vs. anthropogenic drivers of climate change. Sea-level change – proxies, reconstructions & predictive modelling. Environmental change in southern Africa – vegetation change, midden & speleothem records. Human impacts. Evidence for the Anthropocene. Environmental envelope modelling, impacts on biodiversity & predicted responses.

Practicals: A field excursion, laboratory work.

Assessment: Practical assignments (including a field trip) (20%), research project (20%), seminars (10%); 3 h exam (50%).

Subminimum: 40% on exam.

DP Requirement: Not applicable

Students may be required to contribute to costs of fieldwork.

Analytical GIS & Advanced Spatial Modelling

ENVS712 P1 W1   (20L-0T-32P-10S-62H-30R-0F-0G-6A-13W-16C)

Prerequisite Requirement: At least 60% in ENVS316.

Aim: To provide advanced insight into GIS and its applications. Emphasis is on understanding through an analytical modelling approach to spatial problems.

Content: Analytical modelling, techniques for spatial modelling. Statistical analysis and interpretation of geographic data. Spatial database design and manipulation. Error assessment and management. GIS project design and management. Environmental GIS applications.

Practicals: GIS applications for environmental management.

Assessment: Assignment (15%), practical report (10%) seminars (10%), practical
test (15%); 3 h theory exam (50%).

Subminimum: 40% on exam.

DP Requirement: Not applicable

Students may be required to contribute to costs of fieldwork.

Advanced Remote Sensing

ENVS720 P2 W2   (20L-0T-32P-10S-62H-30R-0F-0G-6A-13W-16C)

Prerequisite Modules: ENVS316 or equivalent knowledge.

Aim: To provide an advanced instruction in Remote Sensing, coupled with the use of Geographic Information Systems (GIS) in environmental applications. Emphasis is on understanding through application of techniques.

Content: Image processing. Image restoration. Supervised and unsupervised classification. Quality assessment, including replicability, positional accuracy and thematic accuracy. Vegetation indices and their applications. Time series change and analysis using Remote Sensing with GIS. Decision making using Multiple Criteria Analysis.

Practicals: Application of advanced remote sensing techniques.
Assessment: Assignment (20%), practical reports (15%), practical test (15%); 3 h theory exam (50%).
Subminimum: 40% on exam.
DP Requirement: Not applicable

Applied Geomorphology

ENVS722 PC   (20L-0T-42P-5S-60H-30R-0F-0G-3A-13W-16C)
Prerequisite Modules: ENVS315.
Aim: To impart an understanding of process geomorphology based on the analysis of case studies.
Content: The application of Geomorphology to solving problems in natural and urban environments. Professional ethics; social and economic considerations. Risk assessment and hazard mitigation in geomorphic systems. Case studies to investigate the application of Geomorphology in the solution of environmental problems. The field based identification and remediation of degraded systems through careful process intervention.
Practicals: Field excursion (students to contribute to costs), laboratory work.
Assessment: Major project (25%), assignment (15%), seminars (10%); 3 h Exam (50%).
Subminimum: 40% on exam.
DP Requirement: Not applicable
Offered in either Semester 1 or 2. Students may be required to contribute to costs of fieldwork.

Advanced Biogeography

ENVS723 PC WC   (20L-0T-32P-15S-60H-30R-0F-0G-3A-13W-16C)
Prerequisite Modules: ENVS314.
Aim: To discuss, critically evaluate, synthesize and integrate the various approaches to modern biogeography.
Content: Vicariance biogeography; centres of origin; pan-biogeography; applied historical biogeography; techniques of historical biogeography - retrospection; experimental island biogeography; the man-land paradox and the depletion/conservation of resources; species diversity; modern environmetalism.
Practicals: A field excursion (students to contribute to costs), laboratory work.
Assessment: Practical assignments (20%); major project (20%); seminars (10%); 3 h exam (50%).
Subminimum: 40% on exam.
DP Requirement: Not applicable
Offered in either Semester 1 or 2. Students may be required to contribute to costs of fieldwork.

Environmental Science Res Project

ENVS730 PY WY   (0L-0T-0P-40S-440H-0R-0F-0G-0A-26W-48C)
Prerequisite Requirement: Entry into an appropriate Honours programme.
Aim: To introduce students to research in the environmental sciences.
Content: A significant research project in the environmental sciences, dealing with an appropriate environmental problem and undertaken under the supervision of an academic member of the University staff. Students are expected to present written and oral project proposals and progress reports; and to submit the research dissertation by the set date.
Assessment: Assessment of dissertation (80%) and oral presentations (20%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam. Students may be required to contribute to the costs of the field trip.

Coastal Geomorphology

ENVS741 WC   (20L-0T-14P-15S-78H-30R-0F-0G-3A-13W-16C)
Prerequisite Modules: Entry into an appropriate honours programme
Aim: To develop an understanding of shoreline and off-shore geomorphological history and processes; to study the geomorphological link between catchments and shorelines and to emphasize the impacts of human utilization of the coastal zone.

Content: Geomorphological aspects of oceanic currents; offshore and shoreline processes; tectonics and coastlines; catchment and shoreline geomorphology; human interventions and impacts on coastal geomorphological systems.
Practicals: Field excursion; three afternoon practicals.
Assessment: Seminar presentation (20%), field report (20%), practicals (10%); 3 h exam (50%).
Subminimum: 40% on exam.
DP Requirement: Not applicable
Offered in either semester 1 or 2. Students may be required to contribute to the costs of the fieldtrip.

Contemporary Environmental Issues
ENVS751 PC WC   (20L-0T-35P-10S-62H-30R-0F-0G-3A-13W-16C)
Prerequisite Modules: ENVS322.
Aim: To understand the complexity of contemporary environmental issues of applied environmental science in the southern African and global context.
Content: Hazard assessment in an environmental context; people-environment dependencies; sustainability and biodiversity; energy, fuel and pollution; conservation strategies and policies including Agenda 21, ISO and other international treaties and conventions; environmental ethics and sustainable development; environmental consequences of population movement.
Practicals: Workshops, a major independent assignment and limited fieldwork.
Assessment: Seminars (25%), essay (10%), assignments (15%); 3 h exam (50%).
Subminimum: 40% on exam.
DP Requirement: Not applicable
Offered in either Semester 1 or 2. Students may be required to contribute to costs of field work.

Applied Geographical Information Systems
ENVS810 PC WC   (16L-0T-24P-10S-77H-30R-0F-0G-3A-13W-16C)
Prerequisite Modules: ENVS316 or equivalent.
Aim: To provide insight into the applications of GIS in a southern African context.
Content: Analysis of spatially-related problems facing the modern world, in the southern African context in particular. Advanced concepts of applied GIS. Concepts of geography as a spatial information technology. Use of case studies to illustrate different aspects of GIS theory. Use of GIS-software to acquire and apply analytical skills.
Practicals: Assignments, projects and a field excursion.
Assessment: Practical reports (25%), mini-project (25%), assignment (10%); 3 h theory exam (40%).
DP Requirement: 80% attendance at all academic contact activities; 40% class mark.
Offered in either Semester 1 or 2. Students may be required to contribute to costs of fieldwork.

Internship
ENVS813 HC WC   (0L-0T-0P-0S-160H-0R-0F-0G-0A-13W-16C)
Aim: To gain practical experience in a working environment.
Content: Research project on an appropriate topic during placement, under guidance of School and workplace supervisor.
Assessment: Research report (50%); Work practice report (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or 2. This module has no supplementary exam.

Sustainable Development
ENVS814 WC   (0L-0T-16P-30S-91H-20R-0F-0G-3A-13W-16C)
Prerequisite Requirement: Entry into an appropriate Honours or Coursework Masters' programme.
Aim: To explore the relationship between people and environment using sustainability as a conceptual framework.
Content: This module explores the concepts and principles of sustainability. It is divided into four main sections: theory and philosophy of environmentalism; defining sustainability; principles and management tools for sustainability:

such as sustainability indicators, environmental economics, public participation, and policy processes and sustainability.

Practicals: Fieldwork project.

Assessment: Theory assignment (25%), research report (25%); 3 h Exam (50%).

DP Requirement: 80% attendance at all academic contact activities; 40% class mark.

Offered in either Semester 1 or Semester 2. Students may be required to contribute to the costs of the fieldtrip.

Tools of Environmental Management

ENVS815 WC   (0L-0T-36P-39S-72H-10R-0F-0G-3A-13W-16C)

Prerequisite Requirement: Entry into an appropriate Honours or Coursework Masters' programme.

Aim: To expose students to a wide range of tools, over and above traditional EIA's, that are used in environmental management and to facilitate critical engagement as to their applicability in different situations.

Content: Evaluating sustainability status of various land use categories, risk assessment, environmental management systems, strategic environmental assessment, rapid rural appraisal, ecological footprint analysis, co-management agreements, role of predictive modelling, and environmental ethics.

Assessment: Assignment (25%), research report (25%); 3 h theory exam (50%).

DP Requirement: 80% attendance at all academic contact activities; 40% class mark.

Offered in either Semester 1 or Semester 2. Students may be required to contribute to the costs of the fieldtrip.

Water Resource Management

ENVS817 PC WC   (28L-0T-28P-28S-43H-30R-0F-0G-3A-13W-16C)

Prerequisite Requirement: Entry into an appropriate Honours or Coursework Masters' programme.

Aim: To provide an understanding of the significance as a life-sustaining resource and techniques of managing this resource.

Content: Global water issues. Hydrological concepts. Water management institutions. Policies and Water Act. Water scarcity and management of supply and demand. Sustainability of water resources. Catchment Management.

Practicals: 3 day field excursion and site visits.

Assessment: Article review (20%), term paper (20%), oral presentation (10%); 3 h exam (50%).

DP Requirement: 80% attendance lectures, fieldwork and seminars; 40% Class mark.

Offered in either Semester 1 or Semester 2. Students may be required to contribute towards costs of fieldwork.

Environmental Coursework Masters Dissertation

ENVS820 PY WY   (0L-0T-40P-20S-880H-0R-0F-20G-0A-26W-96C)

Prerequisite Modules: ENVS730.

Aim: To assist students in the completion of a major piece of supervised, independent research.

Content: Identifying a suitable research topic; undertaking a major research project on this approved topic of interest to the Environmental Sciences, and writing the results of such independent research under the supervision of a member(s) of the academic staff.

Assessment: Dissertation (100%).

DP Requirement: Not applicable.

This module has no supplementary exam.

Agricultural Extension

Offered in the School of Agricultural, Earth and Environmental Sciences

Rural Wealth Creation
EXTN161 P1   (39L-0T-35P-0S-60H-10R-0F-12G-4A-13W-16C)
Aim: To provide a) an introduction to rural community development, an understanding of wealth and poverty; and b) skill in structuring projects to facilitate movement of communities along a pathway to prosperity.
Content: The nature of wealth and poverty. Sustainable Livelihoods assets framework for identifying opportunities and projects for development. Project planning.
Practicals: 3 hour field trip to learn about agricultural or rural systems. Weekly 2 hour practical.
Assessment: Project proposal with plan & logical framework (20%), Research paper (20%), Test (10%); 3 h exam (50%). Subminimum to pass: 40% in exam.
DP Requirement: Not applicable
Only for students registered at Cedara College of Agriculture.

Rural Economic Systems
EXTN162 P2   (39L-0T-35P-0S-60H-10R-0F-12G-4A-13W-16C)
Aim: To provide a basic understanding of macro and micro economic systems in the rural socio-agricultural context in relation to facilitating prosperity in rural communities.
Content: Basic concepts in farm economics and integrated rural development; sustainability planning/assessment using a sustainability model; analysis of farm/enterprise systems in the context of the rural community.
Practicals: Day-long field trip to learn about agricultural or rural economic systems. Weekly 2 hour practical. In addition to tuition fees, each student will be required to pay field trip expenses.
Assessment: Test (10%), Learning report (20%), Policy review (20%); 3 h Exam (50%). Subminimum to pass: 40% in exam.
DP Requirement: Not applicable
Only for students registered at Cedara College of Agriculture.

Extension Methods
EXTN261 P1   (45L-0T-0P-0S-75H-16R-0F-20G-4A-13W-16C)
Aim: To introduce different extension models and techniques and to prepare students to apply participatory extension methods in a rural agriculture context.
Content: Perspective, values and attitudes in rural development. Theory of adult learning and experiential learning; introduction to farming systems. Participatory approaches to extension: PLA, PTD, Farmer to Farmer. Policies impacting on extension and rural development. Application of farming systems analysis in the field.
Practicals: One day fieldtrip to a rural community; group presentations and journal writings.
Assessment: Journals (10%), individual presentation (10%), 1 test (10%), field report (20%); 3 h exam (50%).
Subminimum to pass: 40% in exam.
DP Requirement: Not applicable
Only for students registered at Cedara College of Agriculture.

Extension Practice
EXTN262 P2   (45L-0T-20P-0S-75H-16R-0F-0G-4A-13W-16C)
Prerequisite Modules: EXTN261.
Aim: The module offers the opportunity for students to apply the competencies learned in EXTN261 in real extension tasks in resource poor rural communities.
Content: Group dynamics and team contracts, facilitation and presentation skills, active communication strategies; application of participatory techniques.
Practicals: Three-day fieldtrip to a rural community; group presentations, report and project plan writing.

Assessment: Group report (10%), group presentation (10%); individual report (10%); project plan (20%); 3 h Exam (50%). **Subminimum to pass: 40% in exam.**

DP Requirement: Not applicable

Only for students registered at Cedara College of Agriculture.

Designing Extension Projects

EXTN371 P1   (45L-0T-0P-0S-94H-0R-0F-20G-1A-13W-16C)

Prerequisite Modules: EXTN262

Aim: To enable students to (a) apply in a virtual setting the Sustainable Livelihoods analysis, Soft-systems methodology and vulnerability and stakeholder analysis frameworks for determining extension project opportunities that benefit rural communities, (b) develop criteria for, conduct and write a critical policy analysis and (c) design and write a proposal for an extension project based on a theoretical Sustainable Livelihoods analysis.

Content: Sustainable Livelihoods Approach; participatory project planning; developing and applying a theoretical framework for research/policy critique.

Assessment: Policy review (35%); concept note (30%); project proposal (35%).

DP Requirement: Not applicable

There is no separate class mark. All students are required to make an oral defence of their portfolios. After all of the assessments have been marked, they will receive a single final mark for the module. This module has no supplementary exam. Only for students registered at Cedara College of Agriculture.

Participatory Extension

EXTN372 P1   (20L-0T-28P-0S-80H-15R-0F-12G-5A-13W-16C)

Prerequisite Modules: EXTN262

Aim: To develop an understanding of the application of various participatory approaches, techniques and models in a rural socio-agriculture context.

Content: Learning models; group dynamics; participatory development methods and application as part of rural development interventions. The community development cycle and process in rural communities. Expectations of community development practitioners in a rural socio-agriculture context.

Practicals: Two half-day field trips to apply participatory approaches in a rural community to evaluate, identify and plan community project and writing project proposals for funding.

Assessment: Research paper (40%); learning journal (30%); interactive exercise (30%).

DP Requirement: Not applicable

Only for students registered at Cedara College of Agriculture.

Extension Placement

EXTN373 P2   (12L-0T-0P-0S-110H-17R-180F-0G-1A-13W-32C)

Prerequisite Modules: EXTN371, 372

Aim: To enable students to (a) apply in a real-world setting the Sustainable Livelihoods analysis, Soft-systems methodology and vulnerability and stakeholder analysis frameworks for determining extension project opportunities that benefit rural communities; and (b) to track and critically reflect on the application of theory in practice in a real-world setting.

Content: Learning models, Group dynamics, Sustainable Livelihoods approach, participatory project planning; and application of extension theory.

Assessment: Portfolio (placement report, reflection on learning, project proposal) plus 1 h oral defence of portfolio (100%).

DP Requirement: Not applicable

This module has no supplementary exam. Only for students registered at Cedara College of Agriculture.

Farm Business Management

Offered in the School of Agricultural, Earth and Environmental Sciences

Production Economics and Marketing
FBMT151 P2   (39L-0T-32P-0S-40H-20R-0F-24G-5A-13W-16C)
Aim: To provide an introduction to farm business management.
Content: Production economic principles; marketing; market supply and demand.
Practicals: Bi-weekly 2 hour practical.
Assessment: Tests, assignments and practical assessments (60%); 3 h exam (40%).
Subminimum to pass: 40% in exam.
DP Requirement: 40% class mark; 80% attendance at lectures and practicals.
Only for students registered at Cedara College of Agriculture.

Farm Business Management
FBMT262 P1   (39L-26T-0P-0S-60H-20R-0F-10G-5A-13W-16C)
Prerequisite Modules: FBMT151
Aim: To apply agricultural business and management principles to an agricultural production system.
Content: Agricultural business and management principles; financial and physical production records; financial statements; budgets.
Practicals: Bi-weekly 2 hour practical.
Assessment: Tests, assignments and practical assessments (60%); 3 h exam (40%).
Subminimum to pass: 40% in exam.
DP Requirement: 40% class mark; 80% attendance at lectures and practicals.
Only for students registered at Cedara College of Agriculture.

Farm Finance
FBMT371 PY   (34L-25T-40P-8S-180H-30R-0F-0G-3A-26W-32C)
Prerequisite Modules: FBMT262 **Corequisite:** RMGT371.
Aim: To apply farm finance to real agricultural business system.
Content: Farm business management principles; marketing, market demand and supply; financial statements; budgets; farm finance.
Practicals: Weekly 2 hour practical.
Assessment: Assignments and practical assessments (60%); 3 h exam (40%).
Subminimum to pass: 40% in exam DP Requirement: 40% class mark; 80% attendance at lectures and practicals.
Year-long Module. Only for students registered at Cedara College of Agriculture.

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Food Security

Offered in the School of Agricultural, Earth and Environmental Sciences

Introduction to Food Security
FDSC360 P2   (40L-0T-0P-4S-83H-22R-0F-6G-5A-13W-16C)
Aim: To introduce students to the concept of food security, the food security situation in Africa and policy responses and explore possible solutions, types of interventions and food policy options.
Content: Conceptual framework for food security. Access, availability, and utilization. Vulnerability of households. Food security measurements: dimensions and determinants. The right to food. Policy context. Policy making processes. Review of food security policies, strategies, programs, projects and other intervention options. Introduction to monitoring and measuring food security.
Assessment: 1 test (10%), 4 assignments (40%); 3 h exam (50%).

DP Requirement: 40% Class mark.

Food Security Studies

FDSC700 P1   (0L-0T-14P-66S-80H-0R-0F-0G-0A-6W-16C)

Aim: The multi transdisciplinary exploration of food security issues.

Content: Introduction to food security systems and components. South African food security context. Food production, storage and access. Animal, plant, forest and food storage systems. Livelihoods, risk and vulnerability to food insecurity. Household coping strategies. Nutrition. Land reform. Environmental issues. HIV/AIDS, production and livelihoods. Food policy analysis. Food security measurement, management and interventions.

Practicals: Field trip case studies.

Assessment: Summative case study assessment (100%).

DP Requirement: Not applicable.

This module has no supplementary exam.

Food Security Internship

FDSC701 PY   (0L-0T-0P-0S-175H-0R-225F-0G-0A-26W-40C)

Corequisite: FDSC700, PODS701.

Aim: To give students practical experience dealing with food security issues in a community setting.

Content: An individual internship for which the student will prepare at several levels. The primary foci will be integration of disciplines, particularly the student's own discipline with food security, identification of food security issues and collection of data, evaluation of collected information and communication of results to others. This final step will include positive suggestions for dealing with food security issues in the community.

Assessment: Portfolio report (100%).

DP Requirement: Not applicable.

Year-long module. This module has no supplementary exam.

Food Security Dissertation for Diploma

FDSC711 PY   (0L-0T-0P-0S-400H-0R-0F-0G-0A-26W-40C)

Corequisite: FDSC700, 760.

Aim: For students to independently investigate a food security related issue and contribute to the knowledge in any areas/aspect of food security.

Content: Independent investigation of any food security related problem using qualitative or quantitative methodologies. Preparation of a research paper.

Assessment: Research paper (100%).

DP Requirement: Not applicable.

Year-long module. Additional requirement: Access to a computer and the Internet. This module has no supplementary exam.

Food Storage for Food Security

FDSC720 P1   (10L-0T-5P-0S-55H-10R-0F-0G-0A-10W-8C)

Aim: To explore foundational concepts of post-harvest crop storage, food preservation and food safety.

Content: Causes of primary crop and product losses. Micro-organisms responsible for food loss, food contamination, toxin production. Pathological effects of contaminated water and food. Testing for water and food contamination. Preservation methods for food storage: freezing, bottling, salt, sugar, acid, dehydration, pasteurisation, sterilisation, UHT, sanitation, UV radiation.

Practicals: Demonstrations and hands-on participation in exercises, visits to local (university and/or industry) sites.

Assessment: 3 class assignments (33%), externally examined poster case study assignment (67%).

DP Requirement: Not applicable.

Additional requirement: Access to the Internet. This module has no supplementary exam.

Food Access for Food Security

FDSC730 P1   (20L-0T-0P-0S-60H-0R-0F-0G-0A-10W-8C)

Aim: To explore issues related to access to food or the means to purchase food and related nutrition and food utilisation issues.

Content: Issues relating to access to food and the means to purchase food, including gender dynamics, livelihoods, intra-household allocation, HIV, and food preferences. Nutrition requirements of various population groups, food utilisation and how food access affects nutritional status.

Assessment: 4 assignments (33%), poster (67%).

DP Requirement: Not applicable.

Additional requirement: Access to the Internet. This module has no supplementary exam.

Sustainable Livelihood Options

FDSC755 P1   (25L-0T-0P-2S-38H-0R-0F-15G-0A-13W-8C)

Aim: To investigate possibilities for promoting food security though strengthening and protecting household livelihoods.

Content: Sustainable Livelihood theories. Food security as one outcome of sustainable livelihoods. Livelihood analysis.

Assets, vulnerability, shocks, stresses and trends. Policy and institutional roles. Opportunity assessment.

Assessment: Report on an independent field sustainable livelihood analysis and evaluation (100%).

DP Requirement: Not applicable.

Additional requirement: Access to the Internet. This module has no supplementary exam.

Introduction to Research Methods

FDSC760 P1   (25L-0T-15P-2S-38H-0R-0F-0G-0A-26W-8C)

Aim: For students to develop the necessary skills for writing a research proposal and capacity in academic writing and reporting.

Content: Scientific method of enquiry. Research question formulation, selecting appropriate methodologies, sample design and selection, qualitative and quantitative methodologies, social statistics, data analysis and writing of research projects and criteria for evaluation, writing seminars, research papers and research briefs. Requirements for publishing research findings. Development of arguments. Writing literature reviews. Citing and referencing techniques.

Assessment: 1 quiz (15%), assignment (15%), project proposal (70%).

DP Requirement: Not applicable.

Year-long module. Additional requirement: Access to the internet. This module has no supplementary exam.

Transdisciplinary Food Security

FDSC800 P1   (0L-0T-14P-66S-80H-0R-0F-0G-0A-6W-16C)

Aim: To conduct a transdisciplinary exploration of advanced food security issues.

Content: The interaction of food security systems and components. South African and regional food security context. Food production, storage and access. Animal, plant, forest and food storage systems. Livelihoods, risk and vulnerability to food insecurity. Household coping strategies. Nutrition. Land reform. Environmental issues. HIV/AIDS, production and livelihoods. Food policy. Food security measurement, management and interventions.

Practicals: Field trip case studies.

Assessment: Summative critique of regional food security shocks and threats (100%).

DP Requirement: Not applicable.

This module has no supplementary exam.

C/W Masters Dissertation in Food Security

FDSC815 PY   (0L-0T-0P-8S-712H-0R-240F-0G-0A-26W-96C)

Corequisite: FDSC840.

Aim: To equip students with knowledge and skills to plan and implement transdisciplinary research in food security issues.

Content: Independent investigation of any food security related problem using qualitative and or quantitative research methods. Preparation of mini-dissertation.
Assessment: Dissertation (100%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Research Methods for Food Security
FDSC840 P1   (50L-0T-0P-0S-110H-0R-0F-0G-0A-6W-16C)
Aim: To equip students with knowledge and skills to plan and implement transdisciplinary research.
Content: The scientific method. Types of research. Research design: Populations vs. Samples. Qualitative and quantitative data collection techniques and tools and analysis. Information retrieval. Statistical analysis. Scientific writing and reporting. Popular dissemination of research. Moral-ethical aspects of research and publication.
Assessment: Class quiz (10%), research proposal (90%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Food Security Modelling Systems
FDSC860 P1   (0L-0T-40P-40S-80H-0R-0F-0G-0A-6W-16C)
Aim: Exploration of modelling systems applicable to food security evaluation, assessment and projection.
Content: Spreadsheet programming. System analysis. Demographics. Simulations and population projections.
Practicals: Problem-solving exercises. Simulation modelling using spreadsheet programming. Experimental design and evaluation.
Assessment: 5 class assignments (50%), externally examined simulation model (50%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Measuring and Monitoring
FDSC870 P1   (40L-0T-20P-0S-100H-0R-0F-0G-0A-10W-16C)
Aim: Comparison of international food security measurement and monitoring systems.
Content: Food Security indicators (regional, national, household levels). Agric-ecological monitoring systems. Vulnerability Assessments. Household economy approaches. Experiential measurements. Qualitative and quantitative measures. Examples of tools and techniques.
Practicals: Exploration of various international monitoring systems using the Internet.
Assessment: Summative assignment (100%).
DP Requirement: Not applicable.
Additional requirement: Access to the Internet. This module has no supplementary exam.

Essays in Food Security
FDSC880 PB   (0L-0T-0P-0S-160H-0R-0F-0G-0A-13W-16C)
Aim: Individually designed curricula based on individual student requirements to build further knowledge and experience in food security related issues.
Content: Topics and assignments and their assessment to be decided on for each specific case. Module may include seminars, literature reviews or parts of modules from various disciplines.
Assessment: 1 internally examined essay (33%), 2 externally examined essays (67%).
DP Requirement: 40% for internally examined essay.
Offered in Semester 1 and 2. This module has no supplementary exam.

Markets for Food Security
FDSC890 P1   (40L-0T-20P-0S-100H-0R-0F-0G-0A-13W-16C)
Aim: To explore basic market concepts, assessment, monitoring and analysis for food security analyses.

Content: Basic market concepts; identification and use of market indicators; assessment tools and basic market analysis (sub national, national and regional levels with links to household level). Relevance and application of markets to vulnerability assessments, food security analysis and early warning. Examples of tools and techniques, group and individual exercises.
Practicals: Exploration of various market related websites and international monitoring systems using the Internet.
Assessment: Summative assignment (100%).
DP Requirement: Not applicable.
Additional requirement: Access to the internet. This module has no supplementary exam.

Farm Engineering

Offered in the School of Agricultural, Earth and Environmental Sciences

Farm Infrastructure & Machinery
FRME153 P1   (20L-0T-16P-0S-15H-5R-0F-12G-12A-13W-8C)
Aim: To provide an introduction to the different infrastructure and equipment that play a pivotal role in farming systems. **Content:** Farm infrastructure; farm machinery and equipment.
Assessment: Tests, assignments and practical assessments (60%); 3 h exam (40%).
Subminimum to pass: 40% in exam.
DP Requirement: 40% class mark; 80% attendance at lectures and practicals.
Only for students registered at Cedara College of Agriculture.

Farm Development
FRME262 P2   (39L-10T-26P-0S-50H-20R-0F-10G-5A-13W-16C)
Aim: To apply farm development principles to an agricultural production system.
Content: Soil classification; land capability; land use planning; conservation planning; surveying.
Practicals: Weekly 2 hour practical.
Assessment: Tests, assignments and practical assessments (60%); 3 h exam (40%).
Subminimum to pass: 40% in exam.
DP Requirement: 40% class mark; 80% attendance at lectures and practicals.
Only for students registered at Cedara College of Agriculture.

Food Science

Offered in the School of Agricultural, Earth and Environmental Sciences

Introduction to Food Science
FSCI120 P2   (39L-13T-36P-0S-37H-30R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 40% in CHEM110.
Aim: To develop Food Science knowledge and skills, in food preparation and processing; and the experimental study of food, its composition and quality.
Content: Measuring techniques. Water, structure, properties, functions, activity. Properties of carbohydrates, proteins & lipids. Enzymes, food additives and undesireables (Artificial sweeteners, hydrocolloids, anti-oxidants, natural toxins, contaminants, etc.). Low fat spreads. Minerals and vitamins. Browning reactions (enzymatic & non-enzymatic). Cereals, types of flour, formation of dough & batter, leavening, gelatinisation.
Practicals: Experimentation and basic preparation of foods as listed above.
Assessment: Tests (25%), prac reports (8%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at practicals.

Further Concepts in Food Science

FSCI210 P1   (39L-13T-36P-0S-47H-20R-0F-0G-5A-13W-16C)

Prerequisite Modules: FSCI120.

Aim: To further develop Food Science knowledge, food preparation techniques & the experimental study of food.

Content: Beverages: chemical composition, types & origins, milk, milk products, milk as a food system, milk foams, cheese. Eggs, vegetables & fruit, alternative protein foods, herbs & spices. Meat structure, chemical composition, postslaughter changes & processing. Poultry & fish. Herbs & spices... Preservation, freezing, irradiation, Ohmic heating & modified atmosphere packaging. Sensory evaluation. Food systems.

Practicals: Advanced food preparation. Experimental study of the effect of processing on food quality.

Assessment: Tests (20%), essay (8%), prac reports (5%); 3 h exam (67%).

DP Requirement: 40% Class mark, 100% attendance at practicals.

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Food Service Management

Offered in the School of Agricultural, Earth and Environmental Sciences

Food Production, Systems & Plans

FSMT332 P1   (39L-0T-28P-0S-60H-28R- 0F-0G-5A-13W-16C)

Prerequisite Modules: FSCI210, NUTR224, DIET237

Aim: To provide the student with knowledge and insight required of a competent foodservice manager.

Content: Trends in the foodservice industry; menu planning, development and implementation; production; systems approach to foodservice management; foodservice systems; sanitation and hygiene (HACCP); facility planning and design; dietary modification in FSMT.

Practicals: Finance practical (recipe adjustment, purchasing); managing a large-scale catering event (laboratory work); food presentation; menu modification for special diets.

Assessment: Practicals (6%), assignments (15%), tests (12%); 3 h exam (67%).

DP Requirement: 40% Class mark, 80% attendance at practicals.

Subminimum to pass: 40% in (exam/assessment)

Management Theory & Practice

FSMT333 P2   (49L-0T-27P-0S-60H-19R-0F-0G-5A-13W-16C)

Prerequisite Modules: FSMT332.

Aim: To provide the student with the knowledge and basic skills needed for managerial effectiveness in the Dietetics profession and in nutrition related areas.

Content: Areas, roles and skills of managers, functions of management, management roles of dietetics and nutrition professionals. Entrepreneurship. Project management, financial management. Marketing. Business plans. Report writing. Human resource management. Supervision. Managing change.

Practicals: Managing a large-scale catering event (laboratory work).

Assessment: Assignment (6%), management task evaluation (15%), tests (12%); 3 h exam (67%).

DP Requirement: 40% Class mark, 80% attendance at practicals.

Subminimum to pass: 40% in (exam/assessment)

Food Service Management Internship in Dietetics

FSMT410 PY   (6L-0T-26P-0S-85H-20R-200F-0G-3A-15W-32C)

Prerequisite Requirement: Students must have passed all Level III and lower modules within the Bachelor of Science in Dietetics and Human Nutrition programme.

Aim: The enable the student to expand the ability to manage a food-service unit and to develop communication skills further.

Content: Large scale food preparation; kitchen administration and management; menu planning; kitchen layout evaluation, kitchen safety and hygiene.

Practicals: Students work in a food-service unit for the duration of the module.

Assessment: Professional evaluation (5%), FSMT practical assignments in the FSMT facility (5%), FSMT assignments (22%), business plan (10%), oral exam (8%); 3h exam (50%, subminimum 40%).
DP Requirement: 40% Class mark.

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Genetics
Offered in the School of Life Sciences

Introductory Genetics
GENE240 P1 W1   (39L-20T-9P-0S-57H-28R-0F-0G-7A-13W-16C)
Prerequisite Modules: (BIOL101 or BIMI120), MATH150.
Aim: To attain an understanding of basic inheritance patterns, cell division and the structure & function of chromosomes.
Content: In depth study of prokaryotic & eukaryotic cellular division & reproduction, revision of inheritance principles. Extensions of Mendelism in allelic variation, gene function & types of gene action, chromosomal basis of Mendelism, sex-determination & linkage. Cytogenetics: variation in chromosome number & structural rearrangements, linkage, crossing-over & mapping; evolutionary processes that modify genomes.
Practicals: Analysis of chromosome behaviour & karyotypes. Tutorial based exercises based on theory content.
Assessment: Tests (35%), tutorials and practical reports (15%), 3h exam (50%).
DP Requirement: Class mark of 40%. 80% attendance at tutorials and 100% at tests. Completion and submission of all assignments on time.

Population and Quantitative Genetics
GENE310 P1 W1   (30L-12T-24P-6S-68H-16R-0F-0G-4A-13W-16C)
Prerequisite Modules: GENE240; (BIOL200 or STAT222)
Aim: To attain insight into populations and quantitative genetics in the context of animal & plant breeding, conservation biology and evolution.
Content: Genetic basis of variation in natural populations: random mating, multiple alleles, sex-linked genes, linkage & linkage disequilibrium. Analysis of quantitative traits: genetic variation, heritability, natural selection, assortative mating, migration, drift, flow, inbreeding, genotype/environment interactions & artificial selection. Application to problems such as animal & plant breeding and conservation biology.
Practicals: Selected from the above. Tutorials. Problem solving exercises.
Assessment: Theory tests (25%), seminars (5%), tutorials & assignments (15%), practicals (5%); 3 h exam (50%).
DP Requirement: Class mark of 40%. Attendance at 80% of tutorials and practicals.

Bioinformatics
GENE320 P1 W1   (30L-9T-36P-0S-55H-25R-0F-0G-5A-13W-16C)
Prerequisite Modules: GENE240 or RDNA202.
Aim: To attain an understanding of the basic theory of bioinformatics and gain practical experience of DNA and protein sequence analysis.
Content: DNA and protein sequence alignment, sequence alignment algorithms, structure function prediction, the organization and use of public domain sequence databases and public domain software, genome annotation and systems biology.
Practicals: Hands-on experience with the retrieval and manipulation of data from online databases.
Assessment: 2 h theory tests (35%), practical reports and assignments (15%); 3 h exam (50%).
DP Requirement: Class mark of 40%. Attendance at 80% of tutorials and practicals.

Genomics and Molecular Diagnostics
GENE330 P2 W2   (30L-6T-27P-0S-71H-21R-0F-0G-5A-13W-16C)
Prerequisite Modules: GENE240, RDNA202.

Aim: To attain an understanding of the organization and analysis of eukaryotic genomes. Insight, skills and experience in recombinant molecular technologies.

Content: Eukaryotic genome organization, gene expression and gene control. The theory of cloning, manipulation and analysis of eukaryotic DNA, RNA and proteins. This includes providing a working knowledge of modern molecular and diagnostic technologies.

Practicals: Analysis of eukaryotic molecular and cellular systems.

Assessment: 2 h theory tests (35%), practical reports (15%); 3 h exam (50%).

DP Requirement: Class mark of 40%. Attendance at 80% of tutorials and practicals.

Integrated Human Genetics

GENE340 W2   (36L-36T-0P-0S-53H-28R-0F-0G-7A-13W-16C)

Prerequisite Modules: GENE240.

Aim: To attain an understanding of the diverse nature of human genetics, and develop competency-based skills to allow future biomedical researchers to successfully integrate genetics, epidemiology & ethics into their practices.

Content: The organisation of the human genome & mapping; somatic cell genetics, identifying the genetics basis of disease; genetic screening & pre-natal diagnosis, treatment of genetic disease; genetic basis of cancer & the immune system; mitochondrial pathology; application of novel scientific discoveries to patient care; breakthroughs in the organisation of the human genome & mapping; contemporary ethical, social & moral issues pertaining to genetics.

Assessment: 2 h theory tests (30%), tutorial reports (20%); 3 h exam (50%).

DP Requirement: Class mark of 40%. Attendance at 80% of tutorials and 100% of tests.

Animal Genetics

GENE350 P2   (30L-6T-30P-2S-55H-30R-0F-0G-7A-13W-16C)

Prerequisite Modules: GENE240.

Aim: To attain insight into how genetic principles may be used to assess and predict, and thereby improve the genetic merit of animal populations.

Content: Aspects of cytogenetics, molecular genetics, population genetics, conservation genetics, quantitative genetics and biotechnology, with special reference to their application and use in animal populations.

Practicals: Field trip, DNA extraction and quantification, gel visualization methods, Restricted Fragment Length Polymorphism (RFLP) marker genotyping, bioinformatics (including population stratification, diversity measures etc) using genotype data and problem solving exercises. Tutorials.

Assessment: Seminar (5%), term paper (5%), Class tests (20%), tutorials and assignments (15%), practicals & field visits (5%); 3 h exam (50%).

DP Requirement: Class mark of 40%. Attendance at 80% of tutorials and/or practicals.

Mini Research Project in Genetics

GENE701 PY WY   (0L-20T-300P-1S-158H-0R-0F-0G-1A-26W-48C)

Aim: To provide insight to the principles of conducting research through laboratory based and/or computer based research and to develop the skills to analyze, interpret and present results.

Content: Research project which falls within the thrust of the school's research area. This includes a relevant literature survey and the execution of research.

Practicals: Design and execution of a research project.

Assessment: Report (70%) & 1h oral presentations (30%).

DP Requirement: 50% Class mark. 80% attendance at lectures, tutorials, and practicals, 100% attendance at tests. Completion and submission of all assignments on time.

Year-long Module. This module has no supplementary exam.

Advanced Genomics and Bioinformatics

GENE703 WC   (4.5L-2T-120P-0S-33.5H-0R-0F-0G-0A-13W-16C)

Aim: To provide insight to the principles of conducting research through laboratory based and/or computer based research and to develop the skills to analyze, interpret and present results.

Content: Topics chosen from, but not limited to: Comparative Genomics, genome annotation, genomic sequencing, data management and mining, genetic study design and analysis.
Practicals: Computational exercises and DNA isolation and analysis techniques.
Assessment: Practical reports (100%) (50% externally examined).
DP Requirement: Not applicable.
This module has no supplementary exam.

Methods in Systems Biology
GENE713 P1   (5L-2T-120P-0S-33H-0R-0F-0G-0A-13W-16C)
Aim: To provide insight and develop skills into advanced methods for analyzing genetic and protein networks using laboratory and computational techniques.
Content: Topics chosen from, but not limited to: Mathematical and computational modelling techniques for genetic and protein networks, network motif identification methods, control theory and its application to real networks and molecular biology techniques and analysis.
Practicals: Hands-on experience with bioinformatics and computational systems biology software including database searches; molecular biology techniques including DNA isolation, quantification and analysis techniques.
Assessment: Mini-paper (50%), computational assignments (40%), technical essay (10%) (50% externally examined).
DP Requirement: Not applicable.
Module taught in the semester prescribed in the Honours handbook. Subminimum to pass: 40% minimum in each component.
This module has no supplementary exam.

Genetics Research Skills
GENE714 P1   (4L-30T-0P-2S-117H-0R-0F-6G-1A-13W-16C)
Aim: To provide strategies to find, organise, & critically evaluate scientific literature in molecular and/or quantitative genetics with an emphasis on the manipulation & interpretation of in silico data. To train students how to present scientific results orally % in essay and poster format.
Content: Scientific presentation skills, literature database searches, scientific standards and plagiarism, analyzing and evaluating scientific literature, planning and organising an essay and poster on a selected topic.
Assessment: Oral presentations (20%), scientific report (30%), class test (20%), scientific essay and/or poster (30%). (50% externally examined).
DP Requirement: Attendance at 80% of practicals and 100% of tests.
This module has no supplementary exam.

Advanced Population & Quantitative Genetics
GENE715 P1 W1   (12L-10T-20P-4S-97H-0R-0F-12G-5A-13W-16C)
Aim: To advance and integrate knowledge of quantitative & population genetics with concepts of statistics and biology in their application within populations and genomes. To familiarise students with the concepts, theories and methodology involved in the application of genetic principles to populations and genomes.
Content: A selection of topics in Population & Quantitative Genetics including but not limited to: Measures of genetic diversity, allele frequencies & Hardy-Weinberg, inbreeding & kinship, selection, drift, mutation, migration, neutral theory, population structure, QTL mapping, estimation of genetic parameters, selection index & multivariate selection.
Assessment: Assignments (30%), seminar (20%); 3 h exam (50%).
DP Requirement: Attendance at 80% of practicals and 100% of tests.

Advanced Seminar Topics in Genetics
GENE716 P1 WC   (0L-12T-9P-3S-136H-0R-0F-0G-0A-12W-16C)
Aim: To conduct advanced and comprehensive reviews of selected topics in genetics and to present these in a written and oral format.
Content: Relevant highly contemporary topics from the sub-disciplines of Genetics, such as bacterial, plant, animal, human and medical Genetics, as well as genomics and bioinformatics.

Assessment: Oral presentations (50%) and written assignments (50%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Advanced Animal Breeding & Genetics

GENE718 P2   (24L-24T-6P-12S-64H-3R-0F-24G-3A-13W-16C)
Aim: To increase understanding of genetic principles and their applications on genetic improvement of livestock and wild life populations.
Content: Brief revision of basic principle of inheritance, population genetics, genetic & phenotypic variation. Principles of selection applied to animal production & conservation. Industry programmes for genetic evaluation (BLUP), mating systems & modern techniques of animal breeding (AI, MOET, Gene mapping and QTL identification and gene transfer). Construction of breeding programmes. Breeding programmes for selected livestock species. Conservation genetics programmes.
Assessment: Assignments (30%), seminar (10%), term paper (10%); 3 h exam (50%).
DP Requirement: Attendance at 80% of tutorials and/or practicals.

Human Genetics and Molecular Diagnostics

GENE719 W2   (20L-24T-18P-6S-58H-17R-0F-12G-5A-13W-16C)
Prerequisite Requirement: Credit-weighted average of 55% in Level-3 Genetics modules.
Aim: To provide insight to the key concepts in Human Genetics, pharmacogenetics and pharmacogenomics. To provide an understanding of modern molecular and diagnostic techniques of various human genetic diseases.
Content: Overview of the genetic basis of human diseases, sex-linked disorders and family relationships. Role of heredity in the development of disease. Human genome and the significance of human genome sequence in understanding human genetics. Key concepts and methodologies in Pharmacogenetics and Pharmacogenomics. Modern molecular techniques applicable for diagnosis of human genetic diseases.
Assessment: Tests & assignments (30%), seminars & tutorials (20%); 3 h exam (50%).
DP Requirement: Attendance at 80% of lectures, tutorials and practicals, and 100% of tests.

DNA Typing in Forensic Investigation

GENE751 WC   (27L-10T-30P-4S-23H-30R-0F-0G-36A-7W-16C)
Aim: For students to become acquainted with the principles of DNA typing in Forensic Investigation.
Content: Structure of human genomes. DNA marker systems. Kits and ladders commonly used in forensic analysis. Interpreting DNA profiles. Gender identification. Mitochondrial DNA analysis.
Practicals: DNA isolation, DNA quantitation using real-time PCR, PCR amplification of STR's, fragment analysis.
Assessment: Seminars (10%), practicals (20%), problem sets (20%), tests (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or 2. This module has no supplementary exam.

Forensic Genetics: Analysis & Interpretation

GENE752 WC   (27L-10T-20P-4S-33H-30R-0F-0G-36A-7W-16C)
Prerequisite Modules: GENE751.
Aim: For students to become acquainted with the statistical interpretation of DNA profiles in a forensic context.
Content: Allele frequency databases; DNA genotype/ profile frequency estimation; matching DNA profiles; DNA profile storage; parentage and kinship determination. Use of STRlab and GeneMapper software to interpret DNA profiles. Interpreting DNA profiles: report writing.
Practicals: Will comprise guided interpretations of DNA profiles using current software packages.
Assessment: Practicals (20%), assignments (30%), tests (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or 2. This module has no supplementary exam.

Professional communication in forensic genetics
GENE755 WA   (24L-6T-0P-18S-46H-30R-0F-0G-36A-6W-16C)
Prerequisite Module: GENE751.
Aim: For students to become acquainted with the principles and practise of presenting DNA profiling data, both in writing as a professional report and verbally in court as an expert witness..
Content: Forensic evidence, legislation and the court system in South Africa. The course of a criminal case. Types of evidence and factors affecting the admissibility of DNA evidence in a court of law. The role of the witness. Procedures during the criminal trial. Performance on the witness stand and the provision of testimony in a court of law. Building a case with DNA evidence. An overview of the analysis and interpretation of short tandem repeats (STRs). Standard court questions about STRs.
Practicals: None.
Assessment: Written assignments - 25%, oral assignment – 25%, tests – 50%.
DP Requirement: Not applicable.
Offered in Semester 1

Quality assurance in forensic genetics laboratories
GENE753 WB   (24L-12T-0P-0S-58H-30R-0F-0G-36A-6W-16C)
Prerequisite Module: None.
Aim For students to become acquainted with procedures for quality assurance in forensic laboratories.
Practicals: None.
Assessment: Assignments - 50%, tests – 50% (To be externally examined).
DP Requirement: Not applicable.
Offered in Semester 2

Forensic Genetics Research Project
GENE756 WB   (0L-12T-0P-0S-178H-0F-0G-290A-30W-48C)
Prerequisite Module: None.
Aim: For students to gain experience in formulation, planning, execution, analysis and reporting of a research project, and mastery of relevant forensics techniques.
Practicals: . No formal (timetabled) practicals or field trips but students are expected to engage with practical and field work as required by their project.
Assessment: Seminars (10%), written proposal (5%), project (85%).
DP Requirement: Not applicable.
Offered in Semester 2

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Geography

Offered in the School of Agricultural, Earth and Environmental Sciences

Human Environments
GEOG110 H1 P1 W1   (39L-8T-30P-0S-67H-10R-0F-0G-6A-13W-16C)
Aim: To introduce students to basic concepts in human geography.
Content: The central themes in this module are society-space and nature-society linkages. These are grounded in the African social, economic and political context and further explored in relation to processes of globalisation and uneven development. Fundamental concepts are: global/local interactions at different scales; spatial variation and spatial interaction; individual agency in the face of larger economic and social structures; human-environment interactions at different scales. Practicals form an integral part of the theory and utilise map skills.
Assessment: Practicals/Assignments (20%), Tests (30%); 3 h theory exam (50%).
NB: Subminimum of 40% on exam.
DP Requirement: Not applicable.
This module is only for students that are registered for a major or programme in which this module is specifically listed as core or as a core elective.

Geographies of Urban and Rural Change

GEOG220 H2 P2 W2   (39L-0T-33P-0S-61H-20R-0F-0G-7A-13W-16C)

Prerequisite Modules: GEOG110.

Aim: To introduce students to spatial transformations in urban and rural contexts in southern Africa.

Content: Spatial transformations in urban and rural contexts are explored in light of appropriate theory drawn from urban, economic, cultural and political geography. Regional change is interpreted in the context of post-apartheid planning and development practice, as well as in the global economy. Particular attention is paid to contested urban landscapes and new urban forms; the impact of land reform initiatives & the spatial impacts of development theory and planning.

Assessment: Practicals/Assignments (20%), Tests (30%); 3 h exam (50%).

NB: Subminimum of 40% on exam.

DP Requirement: Not applicable.

Only for students majoring in GEOG/ENVS or an appropriate programme with the module as core subject to the approval of the Academic Leader.

Tourism Studies

GEOG301 H1 P1   (36L-0T-33P-0S-69H-17R-0F-0G-5A-13W-16C)

Prerequisite Modules: GEOG220

Aim: To introduce students to conceptual and theoretical aspects of leisure, recreation and tourism in the context of planning for sustainable tourism development.

Content: Conceptual and theoretical issues in leisure. Recreation and tourism. Historical development of tourism. The economics of tourism development. Principles of sustainable tourism development, forms of tourism development. The sustainability of ecotourism. Environmental policies and impact control measures. Policy management and planning for tourism development in South Africa.

Practicals: Collection and analysis of data, report presentation and field excursion.

Assessment: Tests (25%), assignments (5%), practicals (20%); 3 h exam (50%).

NB: Subminimum of 40% on exam.

DP Requirement: Not applicable.

Students may be required to contribute to the costs of field trips.

This module is only for students that are registered for a major or programme in which this module is specifically listed as core.

Land Issues and Rural Development in SA

GEOG314 H2   (27L-0T-36P-0S-72H-20R-0F-0G-5A-13W-16C)

Prerequisite Modules: GEOG220

Aim: To deepen understanding of land issues in the African context.

Content: Explanations of rural poverty (including globalization and HIV/AIDS). Historical background to the land question in Southern Africa. Land demand and use in Southern Africa. Natural resources and rural development, rural livelihoods and food security. Women/gender and rural development, and enhancing conditions for the promotion of rural development.

Assessment: Assignments (15%), tests (15%), project (20%); 3 h theory exam (50%).

NB: Subminimum of 40% on exam.

DP Requirement: Not applicable.

This module is only for students that are registered for a major or programme in which this module is specifically listed as core.

Political Ecology

GEOG320 P2   (36L-6T-30P-30S-64H-14R-0F-0G-10A-15W-16C)

Prerequisite Module: GEOG220

Aim: To introduce students to the study of political ecology and its usefulness in understanding the geography of humanenvironment relations, particularly in Southern Africa. Political ecologists focuses on the political, social, cultural and economic sources, conditions and ramifications of environmental change and interaction.

Content: Social Nature and the Production of Nature, Political Ecology Theory, the political ecology of conservation and forestry, neoliberal nature, environmental conflict, environmental justice and liberation ecologies, feminist political ecology, indigenous environmental knowledge, more-than-human political ecology, advances/conflicts in political ecology theory.

Practicals: 1 x 3hr practical each week

Assessment: Essays 15%, Tutorials/Practicals 15%, tests 20%, exam (3 hour) (50%).

NB: Subminimum of 40% on exam.

DP Requirement: Not applicable.

This module is only for students that are registered for a major or programme in which this module is specifically listed as core.

Sustainable Cities and Development

GEOG330 H2 P2   (26L-0T-36P-4S-69H-20R-0F-0G-5A-13W-16C)

Prerequisite Modules: GEOG220.

Aim: To develop an understanding of sustainable urban processes in Sub-Saharan Africa, and to appraise these in the context of development theory and practice.

Content: Contemporary transformation and urban change within cities; strategies for urban sustainability and growth. Urban policies, democratization, decentralization and social movements. People-land relationships and urban land use in Africa.

Assessment: Assignments (25%), practicals (25%); 3 h exam (50%).

NB: Subminimum of 40% on exam.

DP Requirement: Not applicable. .

This module is only for students that are registered for a major or programme in which this module is specifically listed as core.

Concepts and Methods in Geography

GEOG700 H1 P1   (20L-0T-8P-30S-79H-20R-0F-0G-3A-13W-16C)

Prerequisite Requirement: Entry into an appropriate Honours programme.

Aim: To consolidate the principles, philosophy and methods of Geography as a holistic, applied environmental science, within a spatial and temporal context.

Content: Debates on philosophical and methodological theories, concepts and paradigms informing and contextualizing methods with an emphasis on a variety of quantitative and qualitative methods available to conduct geographical research.

Practicals: Workshops, presentations and assignments.

Assessment: Assignments (20%), essay (15%), term paper (15%); 3 h exam (50%).

NB: Subminimum of 40% on exam.

DP Requirement: Not applicable.

Students may be required to contribute to the costs of the fieldtrip.

Migration, Displacement and Human Rights

GEOG722 HY   (30L-0T-0P-27S-60H-30R-0F-0G-13A-15W-16C)

Prerequisite Requirement: Entry into an appropriate Honours programme

Aim: To introduce students to contemporary trends and debates in migration and its associated impacts, as well as the challenges for migrants and policy makers. At the end of the course students should be able to: understand the different theories of migration; evaluate international migration patterns; explain the gender implications of migration; discuss the different types of forced movements and human rights violations; understand the rise of xenophobia and racism; evaluate trends in human trafficking; and critically assess migration policies in post-apartheid South Africa.

Content: Theories of Migration, International migration and globalisation, transnationalism and citizenship, Migration and development, Gender dimensions of migration, Undocumented/Irregular migration, Refugees, Migrant Smuggling and Human Trafficking, Human rights violations, Policy Debates: Open borders versus sovereignty, South Africa: Post 1994 Policies and Realities

Assessment: Seminars/assignment (15%), Term Paper (35%) and written examination (50%).

NB: Subminimum of 40% on exam.

 DP Requirement: Not applicable.

Geographical Sciences Research Project

GEOG730 PY HY   (0L-0T-0P-40S-440H-0R-0F-0G-0A-26W-48C)

Corequisite: GEOG700.

Aim: To gain experience in the formulation, planning and execution of a research project in the Geographical Sciences. To identify & execute a significant research project in one of the sub-disciplines of Geography within the natural sciences, requiring the student to collect, analyse and interpret data; integrate practical & theoretical knowledge; develop independent critical thought and communicate the results effectively in both written & oral reports.

Content: The projects will be decided in discussion between the supervising staff & the individual student. The project must be submitted in the format as required by one of the journals of the discipline appropriate to the selected project.

Assessment: Oral presentations (20%), Dissertation (80%).

DP Requirement: Not applicable.

Year-long Module. This module has no supplementary exam. Students may be required to contribute to the costs of the fieldtrip. For students in the College of Agriculture, Engineering and Science only.

Natural Resources & Sustainable Land Use

GEOG733 HC   (20L-0T-38P-10S-62H-27R-0F-0G-3A-13W-16C)

Prerequisite Requirement: Entry into an appropriate Honours programme.

Aim: To examine NRM and SLU issues utilising problem-based, interdisciplinary and field-orientated approaches.

Content: Resource management theories and debates, ecosystem management, field-based methodologies, sustainable land use, natural resource management strategies, institutional dynamics, conflict resolution, policy aspects, constraints and capacities.

Practicals: Workshops, projects and fieldwork.

Assessment: Presentations (20%); assignments (30%) 3 h exam (50%).

NB: Subminimum of 40% on exam.

DP Requirement: Not applicable.

Offered in either Semester 1 or 2. Students may be required to contribute to costs of fieldwork.

Rural Development & Land Reform

GEOG735 PC WC   (0L-0T-26P-36S-68H-27R-0F-0G-3A-13W-16C)

Prerequisite Requirement: Entry into an appropriate Honours programme.

Aim: To examine rural change and challenges in developing contexts.

Content: Social differentiation in rural areas; rural governance and political dynamics; knowledge systems and social capital; rural-urban linkages; food security and agricultural issues; off-farm income generating/livelihood sustaining activities; rural service provision, appropriate technologies; review of relevant rural development policies; monitoring/management and research issues in rural development.

Practicals: Workshops, projects and a field excursion.

Assessment: Assignments (25%), research report (25%); 3 h exam (50%).

NB: Subminimum of 40% on exam.

DP Requirement: Not applicable.

Offered in either Semester 1 or Semester 2. Students may be required to contribute to costs of fieldwork.

Advanced Tourism Studies

GEOG744 PC   (0L-0T-38P-30S-62H-27R-0F-0G-3A-13W-16C)

Prerequisite Requirement: Entry into an appropriate Honours programme.
Aim: To develop critical expertise in the analysis of tourism issues in the developing world.
Content: Concepts and theoretical aspects of tourism, the production of tourism spaces, places and forms, globalization and tourism, trends in tourism development, tourism impacts, tourism and sustainable development and tourism in Southern Africa.
Practicals: Workshops, projects, and field excursions.
Assessment: Term paper (20%), assignments (20%), seminar presentations (10%); 3 h exam (50%). NB: Subminimum of 40% on exam.
DP Requirement: Not applicable.
Offered in either Semester 1 or 2. Students may be required to contribute to costs of field trips.

Managing Environmental Conflicts
GEOG791 PC WC   (20L-0T-14P-15S-78H-30R-0F-0G-3A-13W-16C)
Prerequisite Modules: ENVS322.
Aim: This module enhances the understanding of key concepts and theories in environmental conflicts and conflictsensitive adaptation under conditions of environmental change.
Content: Key conceptual frameworks such as conflict theory, political ecology/economy and Sustainability Science. Thematic issues of concern for adaptation include an examination of socio-spatial vulnerabilities, geopolitics and the role of corporations in environmental conflict. The module considers tools and policies for conflict-sensitive adaptation to environmental change, including EIA, SEA, IPAT, ecological foot-printing, cleaner production, risk assessments and livelihoods frameworks.
Assessment: Class mark (50%); 3 h exam (50%).
NB: Subminimum of 40% on exam.
DP Requirement: Not applicable.
Available only to students on a programme offered in the Environmental field.

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Geological Sciences

Offered in the School of Agricultural, Earth and Environmental Sciences

Earth and its Materials
GEOL101 W1   (39L-0T-39P-0S-45H-32R-0F-0G-5A-13W-16C)
Aim: To introduce students to the Earth as a dynamic planet and to those processes which operate within and on the Earth's surface.
Content: Introduction to geology; origin of the earth; agents which shaped the Earth's surface; uniformitarianism; geological time and its measurement; introduction to mineralogy and the rock forming minerals; the major rock groups and their characteristics; internal structure of the earth; deformation of rocks; introduction to Plate Tectonics.
Practicals: Exercises related to the earth's tectonic domains; recognition and description of rocks and minerals. 2 days of field excursions may be included as part of practical work.
Assessment: Practical tests (20%), theory tests (20%); field trip and written report (10%); 3 h exam (50%).
DP Requirement: Class mark 40%, 80% attendance at lectures and practicals. Field excursions are compulsory.
Students will be required to contribute to the cost of accommodation and transport related to field work.
Credit may not be obtained for both of GEOL101 and EART130.

Earth's Surface Processes
GEOL102 W2   (39L-0T-39P-0S-45H-32R-0F-0G-5A-13W-16C)
Aim: To introduce the processes which shape the surface of the earth.
Content: Introduction to chemical & mechanical weathering, regolith development; transportation of sedimentary particles by various agents & the resultant landscapes; lithification processes, geologic time, relative & absolute age; stratigraphic correlation; faunal succession; formation & use of fossils; the geological column.

Practicals: Topographic & geological maps: contours & scale; relationship between topography & geology; basic outcrop patterns on geological maps; topographic & geological cross sections. 2 days of field excursions may be included as part of practical work.

Assessment: Practical exercises (20%), tests (30%); 3 h exam (50%).

DP Requirement: Class mark 40%; 80% attendance at lectures and practicals. Field excursions are compulsory. **Students may be required to contribute to the cost of accommodation and transport related to field work.**

Geology Field Module

GEOL200 WV   (0L-0T-97P-10S-50H-0R-0F-0G-3A-6W-16C)

Prerequisite Requirement: 40% in GEOL205 and GEOL220.

Prerequisite Modules: GEOL101, 102.

Corequisite: GEOL202, 205.

Aim: To learn the basic skills and field techniques required in compiling a geological map and accompanying geological report on a field area.

Content: 7 to 10-day field trip in the University vacation. Recognition and description of different rock types and rock associations in the field; measuring structures in outcrop; field techniques and geological mapping; interpretation of field observations; geological synthesis of field area based on geological map and outcrop evidence; verbal presentation of findings.

Assessment: Field exercises, field map and cross section (40%), verbal presentations (10%), written report and final map (50%). No formal examination.

DP Requirement: Attendance on field trip and all pre-trip exercises.

Restricted to students registered for the Programme in Geological Sciences. In addition to tuition fees, each student will be required to purchase a field kit and to contribute to the cost of subsistence, accommodation and transport. Students who do not satisfy the prerequisite requirements will have to de-register from the module. This module has no supplementary exam.

Mineralogy

GEOL201 W1   (15L-0T-18P-0S-31H-12R-0F-0G-4A-6W-8C)

Prerequisite Modules: GEOL101, 102; CHEM110.

Aim: To understand the structural and chemical properties of minerals as well as their distribution and significance in solid earth and surface environments.

Content: Principles of crystallography and crystal chemistry; physical properties of minerals; classification of minerals, their composition, structure, occurrence, technical and economic significance; mineral stability; introduction to X-ray diffraction analysis.

Practicals: Crystallographic exercises; mineralogical calculations and plots, X-ray diffraction exercises.

Assessment: Practical exercises (25%), theory tests (25%); 3 h exam (50%).

DP Requirement: Class mark 40%; 80% attendance at lectures and practicals.

Mineral Microscopy

GEOL202 W1   (15L-0T-18P-0S-31H-12R-0F-0G-4A-6W-8C)

Prerequisite Modules: GEOL101, 102.

Corequisite: GEOL201.

Aim: To acquire the essential skills for optical identification and analysis of minerals. To introduce thin section microscopy as a basic tool for understanding the petrography of sedimentary, igneous and metamorphic rocks.

Content: Principles of mineral optics; identification and description of non-opaque minerals using the polarized-light microscope.

Practicals: Examination of common rock-forming minerals under the microscope.

Assessment: Tests (50%); 2 h exam (50%).

DP Requirement: Class mark 40%; 80% attendance at lectures and practicals.

Admission to this module is restricted to students registered for the Programmes in Geological Sciences.

Sedimentary Petrology

GEOL205 W1   (15L-0T-18P-0S-31H-12R-0F-0G-4A-6W-8C)

Corequisite: GEOL201, 202.

Aim: To gain an understanding of the concepts of grain size distribution, textures and structures of sedimentary rocks, and the characteristics of terrigenous, chemical and biochemical sedimentary rocks.

Content: Particles and grain size analysis; textures of sedimentary rocks, rudaceous rocks, arenaceous rocks, argillaceous rocks, limestone, dolomite and their formation processes.

Practicals: Particles and grain-size analysis, identification of sediment and rock specimens, sedimentary structures, microscopic analysis of thin sections from sedimentary rocks.

Assessment: Practical exercises (20%), tests (30%); 2 h exam (50%).

DP Requirement: Class mark 40%; 80% attendance at lectures and practicals.

Students may be required to participate in fieldwork and contribute to the cost thereof.

Principles of Igneous & Metamorphic Petrology

GEOL206 W2   (29L-0T-39P-0S-59H-25R-0F-0G-8A-13W-16C)

Prerequisite Modules: GEOL201, 202, CHEM120.

Aim: To introduce petrological concepts & tools required for the description, analysis & interpretation of igneous & metamorphic rocks.

Content: Systematic classification of igneous rocks; phase diagrams igneous textures structures & field relationships major trace element & isotope geochemistry; composition of the mantle & the origin of basalts; compositional & structural characteristics of metamorphic rocks physio-chemical controls on metamorphic rock formation; metamorphic phase equilibria.

Practicals: Advanced mineral microscopy; petrography of igneous & metamorphic rocks.

Assessment: Practical exercises (20%), tests (20%); 2 h theory exam (30%), 2 h practical exam (30%).

DP Requirement: Class mark 40%; 80% attendance at lectures and practicals.

Subminimum to pass: 40% in (exam/assessment)

Geochemistry

GEOL211 W2   (15L-0T-18P-0S-31H-12R-0F-0G-4A-6W-8C)

Prerequisite Modules: GEOL101, 102, CHEM110, 120.

Aim: To Introduce the principles of geochemistry, the geochemical structure of the Earth and marine geochemistry.

Content: Distribution of elements in the Solar System; the solid Earth and the oceans; the Periodic Table; analytical methods; geochemical characterization of rocks, sediments and water; introduction to environmental and biogeochemistry; geochemical exploration.

Practicals: Familiarization with the Periodic Table; analytical methods; how to use and interpret geochemical data; geochemical characterization of rocks, sediments and water.

Assessment: Practical exercises (25%), tests (25%); 3h exam (50%).

DP Requirement: Class mark 40%; 80% attendance at lectures.

Palaeontology

GEOL214 W2   (15L-0T-18P-0S-31H-12R-0F-0G-4A-6W-8C)

Prerequisite Modules: GEOL101, 102.

Aim: To introduce students to the broad concepts of Palaeontology with the focus on Invertebrate Palaeontology.

Content: Fossils and fossilization; palaeoecology; evidence in the fossil record for evolution and extinction; invertebrate palaeontology; microfossils; biostratigraphy.

Practicals: Recognition and description of fossilised: Bivalves, Gastropods, Cephalopods, Brachiopods, Trilobites, Corals, Echinoderms and selected microfossils.

Assessment: Practical exercises (20%), tests (30%); 2 h exam (50%).

DP Requirement: Class mark 40%; 80% attendance at lectures and practicals. Note:

Elective module offered subject to staff availability.

Elements of Geology for Civil Engineers

GEOL215 H2   (39L-0T-45P-0S-47H-20R-0F-0G-9A-13W-16C)

Aim: To provide an introduction to geology for Civil Engineers.

Content: Elements of petrography, geomorphology and structural geology. Aspects of engineering geology including soil types, open and subsurface excavations, foundations, dams and reservoirs, building materials. Construction and interpretation of geological maps and profiles.

Practicals: Solving engineering geological problems, map interpretation, mineral and rock identification, discontinuity analysis.

Assessment: Practical exercises (15%), tests (25%); 3 h exam (60%).

DP Requirement: 40% Class mark, 80% attendance at both lectures and practicals. **For Engineering students only.**

Brittle Deformation of Rocks

GEOL220 W1   (15L-0T-18P-0S-31H-12R-0F-0G-4A-6W-8C)

Prerequisite Modules: GEOL101, 102.

Aim: To introduce students to the structures produced by the deformation of rock material and the factors that influence the formation of these structures.

Content: Definition of deformation; recognition of deformation in rock material; brittle and ductile deformation; fault geometry and nomenclature; linked fault systems; fault rocks, joints, fold geometry and nomenclature; mechanisms of igneous intrusion.

Practicals: Geological map exercises, stereographic projection problems, Mohr diagrams.

Assessment: Practical exercises (30%), tests (20%); 2 h exam (50%).

DP Requirement: 40% Class mark; 80% attendance at both lectures and practicals.

Igneous and Metamorphic Processes

GEOL301 W1   (29L-0T-39P-0S-63H-24R-0F-0G-5A-13W-16C)

Prerequisite Modules: GEOL206.

Aim: Using mineralogical, chemical and textural information from igneous and metamorphic rocks to understand the processes and conditions of rock formation.

Content: Quantitative assessment and modelling of major, trace and isotope geochemical data; melt petrogenesis and differentiation processes within classical petro-tectonic settings. Analysis and interpretation of metamorphic rocks and terrains; phase equilibria in simple and complex systems: metamorphism of ultramafic, mafic and pelitic rocks; prograde and retrograde processes.

Practicals: Appropriate to the above.

Assessment: Practical exercises (25%), tests (25%); 3 h exam (50%).

DP Requirement: 40% Class mark; 80% attendance at both lectures and practicals.

Subminimum to pass: 40% in (exam/assessment)

Ductile Deformation of Rocks

GEOL303 W1   (15L-0T-18P-0S-31H-12R-0F-0G-4A-6W-8C)

Prerequisite Modules: GEOL220.

Aim: To build on the knowledge contained within GEOL220 with emphasis on structures produced by ductile deformation of rocks & the factors that influence their formation.

Content: Strain in a geological context; principals of analysing ductile deformation in complexly deformed terrains; factors controlling ductile deformation; structures developed during ductile deformation (e.g. folds, shear zones, boudins, cusps); deformation fabrics; introduction to strain analysis.

Practicals: Geological map exercises, stereographic projection problems, fold analysis, analysis of ductile shears. Fieldwork: a 3-day excursion.

Assessment: Practical exercises (30%), tests (20%); 2 h exam (50%).

DP Requirement: 40% Class mark; 80% attendance at both lectures and practicals. . Attendance on and completion of field trip.

Students will be required to participate in fieldwork and to contribute to the cost thereof. Subminimum to pass: 40% in (exam/assessment)

Advanced Field Mapping Skills
GEOL304 WV   (0L-0T-97P-10S-50H-0R-0F-0G-3A-6W-16C)
Prerequisite Requirement: GEOL200, 205, 206.
Aim: To build on the knowledge & skills acquired in GEOL200 by introducing established & new mapping techniques as applied to complex geological terrains.
Content: 7-10 day field trip in the winter vacation. Literature, map & aerial photograph search. Field & map skills, including GPS & related GIS skills. Identification, measurement & interpretation of rocks, their relationships & structures.
Interpolation of geological data in areas of incomplete outcrop to produce reliable geological maps & cross-sections. Literature study and scientific writing.
Practicals: Incorporated within content.
Assessment: Pre-trip literature study and essay (15%); field assessment (30%), field map & notebook (5%), written field report and final map, externally examined (50%).
DP Requirement: Attendance on and completion of field trip and all pre-trip exercises. Note: Students that fail to submit the pre-trip exercises will not be allowed to attend camp.
Offered in the winter vacation. In addition to tuition fees, each student will be required to contribute towards the cost of subsistence, accommodation and transport. This module has no formal examination and no supplementary exam.
Subminimum to pass: 40% on final exam

Geological Evolution of Southern Africa
GEOL306 W1   (15L-0T-18P-0S-31H-12R-0F-0G-4A-6W-8C)
Prerequisite Modules: GEOL200.
Aim: To provide an insight into the geological evolution of the southern African sub-continent by studying the entire geological record of the region.
Content: The crustal evolution in Southern Africa; 3.5 billion years of earth history.
Practicals: Description and interpretation of geological maps from the aspects of processes and geological evolution.
Assessment: Practical exercises (25%), tests (25%); 2 h exam (50%).
DP Requirement: Not applicable. **Subminimum to pass: 40% in (exam/assessment)**

Geology of Ore Deposits
GEOL308 W2   (29L-0T-39P-0S-62H-24R-0F-0G-6A-13W-16C)
Prerequisite Modules: GEOL205, 206.
Aim: To provide an understanding of the processes and conditions of ore deposit formation.
Content: Ore deposits formed by igneous, sedimentary/surficial and hydrothermal processes; mineral paragenesis, role of stable isotope and fluid inclusion studies in understanding ore deposits. Plate tectonics and ore deposits.
Practicals: Ore mineralogy and ore petrography.
Assessment: Practical exercises (20%), tests (20%); 3 h theory exam (30%); 3 h practical exam (30%).
DP Requirement: 40% Class mark; 80% attendance at both lectures and practicals.
Subminimum to pass: 40% in (exam/assessment)

Sedimentary Facies and Environments
GEOL310 W2   (15L-0T-18P-0S-31H-12R-0F-0G-4A-6W-8C)
Prerequisite Modules: GEOL205.
Aim: To gain an understanding of the concepts of sedimentary facies and depositional environments.
Content: Concept of sedimentary facies and depositional environments, facies controlling factors, facies change in space and time, facies sequences and cyclicity. Depositional models for fluviatile, aeolian, littoral and deltaic sedimentary sequences.

Practicals: Facies columns and Facies maps. Palaeocurrent analysis, reconstruction of palaeographic maps. Field excursion to study sedimentary facies and palaeodepositional environments.
Assessment: Practical exercises (20%), field report (10%), tests (20%); 2 h exam (50%).
DP Requirement: 40% Class mark; 80% attendance at both lectures and practicals. Attendance on and completion of all field trips.
Students will be required to participate in fieldwork and contribute to the cost thereof. Subminimum to pass: 40% in (exam/assessment)

Environmental Geology
GEOL313 W1   (29L-0T-39P-0S-75H-12R-0F-0G-5A-13W-16C)
Prerequisite Modules: 16C from Level-2 GEOL including GEOL211.
Aim: To provide insight into man's interaction with the geological environment.
Content: Water resources: Hydrological cycle, groundwater, water quality and pollution. Waste management: Landfill site selection, design, siting and operations, disposal of nuclear waste. Environmental pollution: Impact of man, mining & mineral processing. Geomaterials and geohazards.
Practicals: Evaluation of Earth hazards to man, his environment and planning processes
Assessment: Practical exercises (16%), assignments (8%), tests (16%); 3 h exam (60%).
DP Requirement: 40% Class mark; 80% attendance at both lectures and practicals.
Subminimum to pass: 40% in (exam/assessment)

Rock Mechanics
GEOL314 W1   (29L-0T-39P-0S-75H-12R-0F-0G-5A-13W-16C)
Prerequisite Modules: GEOL220, MATH150.
Aim: To provide an introduction to rock mechanics.
Content: Rock behaviour, properties and testing. Deformation and failure of rocks. Assessment of rock strength, hardness and elasticity. Weathering and its influence on rock behaviour. Discontinuities. Rock mass classification.
Practicals: Laboratory testing of rocks and discontinuities.
Assessment: Practical exercises (25%), tests (15%); 3 h exam (60%).
DP Requirement: 40% Class mark; 80% attendance at both lectures and practicals.
Subminimum to pass: 40% in (exam/assessment)

Hydrogeology
GEOL321 W2   (29L-0T-39P-0S-60H-24R-0F-0G-8A-13W-16C)
Prerequisite Modules: GEOL313.
Aim: To provide a qualitative & quantitative understanding of groundwater, its occurrence, composition, exploration & development.
Content: Nature of groundwater & aquifers. Principles of groundwater flow. Flow to wells. The geology of groundwater occurrence. Hydro-geochemistry & introduction to isotope hydrology. Groundwater & wells. Groundwater exploration, development & management. Introduction to hydro-geologic & groundwater flow modelling. One day field to local field area for practical work. Students will be required to contribute to the cost of transport related to field work.
Practicals: Darcy's experiment, Estimation of aquifer parameters, pumping test data analysis, analysis of Hydrochemical & water isotope data, hydrogeological mapping, development of a conceptual hydrogeological & groundwater flow model.
Assessment: Practical exercises (20%), assignments (5%), tests (15%); 3 h exam (60%).
DP Requirement: 40% Class mark; 80% attendance at both lectures and practicals.
Subminimum to pass: 40% in (exam/assessment)

Introduction to Mine Geology
GEOL323 W2   (15L-0T-18P-0S-30H-12R-0F-0G-5A-6W-8C)
Prerequisite Modules: GEOL220.

Aim: To introduce the principal concepts of mine geology, plan reading, mineral resource management, production and overall operational processes in the mining industry.

Content: Introduction to mine and mining terminology. Mining methods, mine mapping and sampling, reading mine plans, mineral reporting codes, mineral resource estimation and evaluation.

Practicals: Mine plan reading skills, identification of different mine layouts associated with a specific mining method. Ore reserve calculations, presentations. Mine visits.

Assessment: Practical exercises and presentations (30%), tests (20%); 2 h exam (50%).

DP Requirement: 40% class mark; 80% attendance at both lectures and practicals.

Subminimum to pass: 40% in (exam/assessment)

Igneous Petrology & Geochemistry

GEOL701 W1   (0L-57T-36P-0S-59H-5R-0F-0G-3A-4W-16C)

Aim: To acquire a high level of knowledge and practical experience in the processes that gave rise to magmas and the crystallized products of those magmas in different tectonic and regional settings.

Content: Advanced aspects of igneous petrology and geochemistry relating to specific areas in southern Africa. These may relate to some or all of the following: continental flood basalts, granite, komatiite, and layered intrusions. Case studies will relate to crustal evolution, magma genesis and mineralization processes. Field studies and sampling, data acquisition and handling, and interpretation are integral parts of the course.

Practicals: Practical applications as applied to the above.

Assessment: Class mark (50%); 3 h exam (50%).

DP Requirement: 40% Class mark.

Students may be required to participate in fieldwork and to contribute to the cost.

Subminimum to pass: 40% in (exam/assessment)

Sedimentology and Basin Analysis

GEOL702 W1   (0L-57T-36P-0S-52H-12R-0F-0G-3A-4W-16C)

Aim: To provide in-depth knowledge of the processes that produce sediments and sedimentary rocks and the analysis of these rocks as sedimentary basin fill.

Content: Subsidence, denudation, flux rates and sediment budget. Classification of sedimentary basins, depositional style of the basin-fill, evolution of the basin-fill, sequence stratigraphy, sedimentary basins in South and southern Africa.

Assessment: Class mark (50%); 3 h exam (50%).

DP Requirement: 40% Class mark.

Students may be required to participate in fieldwork and to contribute to the cost thereof.

Subminimum to pass: 40% in (exam/assessment)

Metamorphic Petrology

GEOL703 W1   (0L-57T-36P-0S-52H-12R-0F-0G-3A-4W-16C)

Aim: To understand the processes of metamorphic rock formation in the framework of lithosphere dynamics, and to be able to recognise and utilise the geological record of metamorphic rocks and terrains in order to reconstruct their geological histories.

Content: Advanced aspects of metamorphic petrology, such as geothermobarometry, pressure-temperature histories of metamorphic rocks, tectonic settings and heat sources of metamorphism, thermal modelling, metamorphic fluids, reaction- and deformation-related microstructures, geochronology.

Practicals: Practical applications as applied to the above.

Assessment: Class mark (50%); 3 h exam (50%).

DP Requirement: 40% Class mark.

Students may be required to participate in fieldwork and to contribute to the cost thereof.

Subminimum to pass: 40% in (exam/assessment)

Ore Deposits

GEOL705 W2   (0L-54T-36P-0S-55H-12R-0F-0G-3A-4W-16C)

Aim: To provide an understanding of the modern techniques of ore genesis studies and an introduction to ore processing techniques.

Content: Advanced ore deposit genesis studies, hydrothermal deposits, volcanic-hosted sulphide deposits, sedimenthosted sulphide deposits, carbonate-hosted deposits and structural controls on mineralisation. The fundamentals of mineral processing technology and the application of mineralogy to ore processing techniques.

Practicals: Ore petrography, fluid inclusion and cathodoluminescence studies

Assessment: Class mark (50%); 3 h exam (50%).

DP Requirement: 40% Class mark.

Subminimum to pass: 40% in (exam/assessment)

Mines Field Class

GEOL706 WV   (0L-0T-0P-0S-160H-0R-0F-0G-0A-2W-16C)

Aim: To provide an insight into geological and engineering aspects of the South African mining industry.

Content: Site visits to study geological, environmental and engineering aspects of the mining industry. No formal lectures.

Assessment: Written report (67%); field assessment (33%).

DP Requirement: Not applicable.

Offered in an appropriate vacation. In addition to tuition fees, each student will be required to contribute towards the cost of subsistence, accommodation and transport.

This module has no supplementary exam. Subminimum to pass: 40% in (exam/assessment)

Research Project

GEOL707 WY   (0L-105T-0P-0S-209H-0R-0F-0G-6A-26W-32C)

Aim: To demonstrate the ability, knowledge background and skills to carry out an independent research project which involves a literature survey and the possibility of generating and assessing new data.

Content: No formal instruction.

Practicals: No formal practicals.

Assessment: Project presentations (20%), Final report (80%).

DP Requirement: Submission of project report by set date.

This module has no supplementary exam.

Subminimum to pass: 40% in (exam/assessment)

Precambrian Tectonics

GEOL708 W2   (0L-57T-36P-0S-52H-12R-0F-0G-3A-4W-16C)

Aim: To investigate the evidence for tectonic processes operating in the early and mid-Precambrian. The principle of Uniformitarianism will be applied to the Precambrian through a study of the tectonic framework of southern Africa.

Content: Techniques of analysing Precambrian terrains. General characteristics of the Archaean era and Archaean terrains worldwide; Archaean terrains of southern Africa; the evidence for plate tectonics in the Archaean; Proterozoic crustal evolution in southern Africa.

Assessment: Class mark (50%); 3 h exam (50%).

DP Requirement: 40% Class mark.

Students may be required to participate in fieldwork and contribute to the cost thereof.

Subminimum to pass: 40% in (exam/assessment)

Structural Geology

GEOL710 W2   (0L-57T-36P-0S-52H-12R-0F-0G-3A-4W-16C)

Aim: To analyse complexly deformed rocks and relate the deformation history to appropriate tectonic processes and regimes.

Content: Advanced aspects of structural geology. Understanding brittle and ductile deformation in extensional and compressional environments. Analysis of structures in Phanerozoic and Precambrian terrains. Techniques of analyzing complexly deformed terrains.
Assessment: Class mark (50%); 3 h exam (50%).
DP Requirement: 40% Class mark.
Students may be required to participate in fieldwork and to contribute to the cost thereof.
Subminimum to pass: 40% in (exam/assessment)

Engineering Geology
GEOL711 W2   (39L-9T-39P-0S-58H-12R-0F-0G-3A-4W-16C)
Aim: To provide insights into specialist aspects of engineering geology.
Content: Clays and clay mineralogy. Problem soils. Dolomitic land. Site investigations. Construction materials, foundations. Engineering geological problems. Reservoirs and dams.
Practicals: Geotechnical core logging and soil profiling, physical properties of problem soils. Site visits.
Assessment: Class mark (33%); 3 h exam (67%).
DP Requirement: 40% Class mark.
Subminimum to pass: 40% in (exam/assessment)

Pollution Studies
GEOL712 W2   (39L-9T-39P-0S-58H-12R-0F-0G-3A-4W-16C)
Aim: To provide a qualitative and quantitative understanding of the type, behaviour and movement of pollutants in the soil and water environment.
Content: Geochemical control on the hydrochemistry of natural water. Sampling methods. Inverse and forward hydrogeochemical modelling. Sources and types of contaminant. Mass transport of solutes. Contaminant plumes.
Practicals: Modelling exercises using the software package PHREEQC. Case studies of water quality problems in South Africa.
Assessment: Class mark (50%); 3 h exam (50%).
DP Requirement: 40% Class mark.

Special Topics
GEOL713 WC   (0L-24T-0P-6S-127H-0R-0F-0G-3A-4W-16C)
Aim: To provide an insight into specialized topics within the sub-disciplines of geology.
Content: Special topics in Environmental geology, Engineering geology, Sedimentary, igneous and metamorphic petrology, Structural geology and tectonics, Geochemistry, Mineralogy, Ore deposit geology and Marine geosciences.
Practicals: Appropriate practicals will be offered for the topic.
Assessment: Continuous (100%); tests and assignments comprising at least 50% of the final mark externally examined.
DP Requirement: 40% Class mark.
Offered in either Semester 1 or 2. This module has no formal examination and no supplementary examination.
Subminimum to pass: 40% in (exam/assessment)

Rock Engineering
GEOL714 W1   (39L-9T-39P-0S-58H-12R-0F-0G-3A-4W-16C)
Aim: To give an understanding of the way rock behaves on the surface and underground and to provide tools for quantifying its properties and variability.
Content: Strength of rock masses. Empirical failure criteria. Rock slope failure mechanisms and analysis. Rockfall hazard. Stresses around underground excavations. Support of underground excavations.
Practicals: Analysis of rock engineering problems. Familiarisation with specialised rock engineering packages.
Assessment: Class mark (33%); 3 h exam (67%).
DP Requirement: 40% Class mark.
Subminimum to pass: 40% in (exam/assessment)

Analytical Techniques in Earth Science

GEOL715 W1 (0L-57T-36P-0S-52H-12R-0F-0G-3A-4W-16C)

Aim: To provide a detailed understanding of the theory, practice & application of analytical techniques relevant to Earth Sciences.

Content: An overview of analytical instruments & techniques commonly used to characterize the composition, structure & texture of Earth materials, including, but not limited to, X-ray analysis, electron beam imaging & analysis, and mass spectrometry. Underlying physico-chemical principles, instrumentation, sample preparation & applications in geosciences are covered for each technique. Topics also include sampling techniques, precision & accuracy, contamination, calibration techniques, presentation & interpretation of analytical results.

Practicals: Practical applications as applied to the above.

Assessment: Class mark (50%); 3 h exam (50%).

DP Requirement: 40% Class mark.

Subminimum to pass: 40% in (exam/assessment)

Geotechnical Engineering

GEOL716 W1 (0L-57T-36P-0S-52H-12R-0F-0G-3A-4W-16C)

Prerequisite Requirement: Entrance to the Honours programme in Geological Sciences.

Aim: To provide students with the basic information and skills required to undertake geotechnical investigations, the analysis of physical and geotechnical properties of soils in relation to the stability of slopes and the estimation of settlement of structures on sands and clays.

Content: Geotechnical investigation techniques. Sampling techniques including trial pits and boreholes. Description of the soil profile. *In situ* testing including SPT and CPT tests, laboratory testing and analysis of settlement. Slope stability analysis.

Practicals: Practical applications as applied to the above.

Assessment: Class mark (33%); 3 h exam (67%).

DP Requirement: 40% Class mark.

Subminimum to pass: 40% in (exam/assessment)

Advanced Coastal and Marine Geology

GEOL717 W1 (0L-57T-36P-0S-52H-12R-0F-0G-3A-4W-16C)

Aim: To assess selected models of coastal and marine environments and apply these to examples found within southern African waters.

Content: Distribution, characteristics and development of Cretaceous and Tertiary ocean basins in southern Africa; sedimentological, statistical and geomorphological models of continental shelf, slope and deep water environments.

Assessment: Class mark (50%); 3 h exam (50%).

DP Requirement: 40% Class mark.

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Human Physiology

Offered in the School of Agricultural, Earth and Environmental Sciences

Introduction to Human Physiology

HPHY210 P1 (39L-0T-29P-0S-62H-20R-0F-5G-10A-15W-16C)

Prerequisite Modules: BIOL101; FSCI120 or CHEM120.

Aim: To provide students with an overview of general human anatomy and a thorough knowledge of basic physiological processes of various systems of the human body.

Content: Introduction to the human body. Levels of organisation in the body. Anatomical regions and positions. Homeostasis and feedback mechanisms. Sensory receptors. The nervous system; neurons and impulses; central; peripheral and autonomic nervous system. Endocrine, respiratory, renal systems and fluid balance. Integumentary system. Temperature regulation. Integration of physiological processes.

Assessment: Practical evaluation (17%), 2 tests (16%), 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at practicals.

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Hydrology

Offered in the School of Agricultural, Earth and Environmental Sciences

Introduction to Physical Hydrology
HYDR210 P1   (39L-10T-40P-0S-48H-15R-0F-0G-8A-13W-16C)
Prerequisite Requirement: 64C at Level 1.
Aim: To develop an understanding of the fundamentals of major components making up the hydrological cycle and human interaction with it.
Content: The key concepts underlying the science of hydrology including studies of rainfall, interception, evaporation, runoff, soil water, systems and anthropogenic impacts on the hydrological cycle.
Practicals: 12 - covering various basic hydrological concepts.
Assessment: Tests (25%), tutorials, practical and other assessments (15%); 3 h practical exam (10%), 3 h theory exam (50%).
DP Requirement: Not applicable
Subminimum requirement: 50% for theory exam

Environmental Aspects of Hydrology
HYDR220 P2   (39L-10T-30P-10S-48H-15R-0F-0G-8A-13W-16C)
Prerequisite Modules: HYDR210.
Aim: To provide students taking agriculture and environmental science options with an understanding of current topics in environmental hydrology and anthropogenic impacts on the hydrological cycle.
Content: Natural and anthropogenic impacts on the hydrological cycle, including climate change impacts and the impacts of forestry; networks and instrumentation; morphometry; and an introduction to soil loss.
Practicals: 12 - covering the subjects above. 1 field trip to a research catchment.
Assessment: Tests (20%), tutorials, practical and other assessments (10%), Seminar (10%); 3h
practical exam (10%), 3 h theory exam (50%).
 DP Requirement: Not applicable
Subminimum requirement: 50% for theory exam

Modelling for Hydrological Design
HYDR310 P1   (39L-10T-40P-0S-42H-20R-0F-0G-9A-13W-16C)
Prerequisite Modules: HYDR210.
Aim: To understand hydrological simulation models commonly used in South Africa and their application to design and water conflict problems.
Content: Application of hydrological models to sustainable integrated water resources management and planning, under varying environmental conditions. Understanding theoretical concepts of hydrological simulation; ability to select appropriate models for particular problems; application of hydrological models to obtain water resources design and planning information; ability to set up and run hydrological models.
Practicals: 12 Practicals. Compulsory 3 day field trip.
Assessment: Tests (20%), tutorials, practicals and other assessments (15%); 3h practical exam (10%), 3h theory exam (55%).
DP Requirement: Not applicable.
Subminimum requirement: 50% for theory exam

Environmental Water Quality

HYDR322 P2   (20L-5T-15P-0S-22H-8R-6F-0G-4A-13W-8C)

Prerequisite Modules: HYDR210.

Aim: To provide an intermediate level of understanding and appreciation of water quality issues in hydrology especially those relevant to southern African conditions, such as eutrophication and *E.coli* problems.

Content: The causes and effects of water quality problems and the potential for simulation modelling thereof, with particular reference to South African conditions.

Practicals: Exercises covering the subjects above, as well as monitoring of a local river.

Assessment: Class tutorials & pracs (20%), 2 class tests (20%); 2 h exam (60%).

DP Requirement: Not applicable

Subminimum requirement: 50% for exam

Applied Hydrology

HYDR324 P2   (39L-10T-40P-0S-42H-20R-0F-0G-9A-13W-16C)

Prerequisite Modules: HYDR310.

Aim: To provide an understanding of applied aspects of hydrology and the ability to solve applied problems.

Content: Interrelationships between principles & theories; applied issues & problem solving, including: Planning for water resources, water resources yield & planning model, legal aspects of dam design, safety evaluation, basic hydraulic principles, techniques for design flood estimation including probability plotting & distribution fitting, unit hydrographs. Rational method, application of SCS techniques, flood routing, the Muskingum & storage indication methods; grassed spillway design; reservoir yield analyses to optimize dam & irrigable area capacity.

Assessment: Tests (20%); Practicals or assignments (5%); Design report (25%); 3 h Exam (50%).

DP Requirement: Not applicable

Subminimum requirement: 50% for Exam and 50% for Design Report

Water Resources Policy, Laws and Institutions

HYDR330 P2   (20L-5T-9P-6S-22H-8R-0F-6G-4A-13W-8C)

Prerequisite Modules: HYDR210.

Aim: To equip students with knowledge regarding the evolution of SA water law and the scientific underpinnings of key aspects thereof.

Content: Principles of Integrated Water Resources Management with specific focus on integrated land and water management and climate change in a South African context. Other foci include South African Water Law, organizational arrangements, institutions, rules and policies for water resources management and contemporary topics based on current case studies.

Assessment: Tests (20%), assignments (20%); 2 h exam (60%).

DP Requirement: Not applicable

Subminimum requirement: 50% for exam

Current Issues in Hydrology

HYDR710 P1   (16L-16T-0P-8S-95H-20R-0F-0G-5A-13W-16C)

Aim: To provide honours level students with an understanding of current and topical issues of importance in hydrological sciences. Specific outcomes include: the ability to understand and synthesis particular topics from scientific literature; an understanding of the philosophy of hydrological science; and understanding of the dynamic nature of the science of hydrology; an awareness of the external forces driving the science.

Content: The study of topical and relevant issues pertaining to the science of hydrology.

Practicals: Exercises covering the subjects above, as well as monitoring of a local river.

Assessment: Class assignments (40%); 3 h exam (60%).

DP Requirement: Attendance at all class meetings. Completion of all assignments.

Integrated Water Resources Management

HYDR720 P2   (24L-18T-8P-0S-85H-20R-0F-0G-5A-13W-16C)

Aim: To provide an integrated understanding of hydrological sciences and an ability to solve applied hydrological problems in an interdisciplinary environment.
Content: The interrelationships between principles and theories learned in preceding courses and the processes they represent. In particular, students should be aware of the integrating nature of the hydrological catchment. Topics include: environmental impact assessment; integrated catchment management; environmental water requirements; water quality issues, water and society.
Practicals: Practicals covering the subjects above as well as visits to sites of relevance.
Assessment: Class assignments (40%); 3 h exam (60%).
DP Requirement: Attendance at all class meetings. Completion of all assignments

Advanced Hydrological Processes
HYDR725 P2   (16L-16T-8P-8S-87H-20R-0F-0G-5A-13W-16C)
Aim: This module is designed to provide honours level students with an in depth understanding of fundamental hydrological processes.
Content: After successful completion this module students should have an in-depth understanding of specific hydrological processes. These include: design flood estimation; soil water and hill slope processes; groundwater modelling; forest hydrology.
Practicals: Practicals covering the subjects above as well as visits to sites of relevance.
Assessment: Class assignments (40%); 3 h exam (60%).
DP Requirement: Attendance at all class meetings. Completion of all assignments

Hydrology Honours Project
HYDR730 PY   (9L-0T-0P-10S-461H-0R-0F-0G-0A-26W-48C)
Aim: To develop techniques and skills in research methods, and to train hydrology honours students to conduct an approved research project as well as prepare and present a scientific report on the results.
Content: Research philosophy and research methods with emphasis on the scientific method. Access and review of scientific documentation. Preparation of a research proposal. Conduct an approved honours level research project and analyse the results. Presentation of results by way of a written scientific document in a specified scientific format as well as orally to a group of academic staff and peers.
Practicals: Dependent on chosen research project.
Assessment: Written reports including research proposal (80%); Oral presentation (20%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam.

Advanced Hydrological Modelling Skills
HYDR795 PY   (30L-12T-40P-0S-203H-30R-0F-0G-5A-26W-32C)
Aim: To apply advanced hydrological skills to water resources problems by simulation modelling.
Content: Collection of data, configuration and application of a model to a specific water resources problem providing skills in: GIS applications; catchment delineation; rainfall surfaces; landuse and soils information; irrigation; crop yield; results analysis; planning scenarios. Progress reports handed in during the year; also, full final project report on the project in full, as if to a client.
Practicals: Site visits, analysis of field data; use of GIS.
Assessment: Work is supervised. Progress & final reports assessed by 3 reviewers (60%); 3 h exam (40%).
DP Requirement: Attendance at all class meetings. Completion of all assignments
Year-long Module.

Spatial Analysis for Water Resources Mngt
HYDR820 PC   (20L-6T-20P-12S-62H-15R-0F-20G-5A-13W-16C)
Prerequisite Modules: ENVS810, 817
Aim: To enable students to apply advanced spatial modelling skills used in water resources assessment, planning and management

Content: The application of spatial decision support systems in water resources management, with foci on linkages between GIS and decision support systems and spatial analysis for water resources management including both surface and groundwater. The use of multicriteria decision analysis techniques rounds off the module.
Assessment: Class mark (30%), Project (30%); 3 h Theory Exam (40%).
DP Requirement: 80% attendance at all academic contact activities, 50% Class mark.
Offered in either Semester 1 or 2.

Earth Observation for Water Resources Mngt.
HYDR825 PC   (20L-6T-20P-12S-62H-15R-0F-20G-5A-13W-16C)
Prerequisite Modules: ENVS810.
Aim: To enable students to identify and utilise sources of earth observation data and information available for hydrological analyses.
Content: The use of satellite-based Earth Observation techniques for the Identification of sources of rainfall, soil moisture, evaporation, surface and groundwater fluxes and other water resources related data and information. The application of these in hydrological analyses and water resources management.
Assessment: Class mark (30%), Project (30%); 3 h Theory Exam (40%).
DP Requirement: 80% attendance at all academic contact activities, 50% Class mark.
Offered in either Semester 1 or 2.

Mathematics

Offered in the School of Mathematics, Statistics and Computer Science

Augmented Quantitative Methods 1
MATH105 P1 W1   (78L-78T-0P-0S-99H-54R-0F-0G-11A-13W-16FC-16DC)
Prerequisite Requirement: HG E or SG D Matric Maths or Level 3 NSC Maths; acceptance into the BCom-4 programme.
Aim: To introduce mathematical techniques for business mathematics and to develop problem solving skills.
Content: This module covers the syllabus of MATH134 and, in addition, supplementary material designed for students who are under-prepared for University-level Mathematics. Students are expected to attend additional lectures, tutorials & undergo additional assessment to a maximum of 160 hours (39L-39T-0P-0S-49.5H-27R-0F-0G-5.5A-13W).
Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.
Credits may not be obtained for MATH105 and any of MATH130, 131, 134, 150 or 195. This module is worth 16 degree credits and 16 foundation credits.

Introduction to Calculus
MATH130 PB WB   (49L-39T-0P-0S-51H-15R-0F-0G-6A-13W-16C)
Prerequisite Requirement: Higher Grade D or Standard Grade A for Matric Mathematics, or NSC Level 5 Maths, or 60% for MATH199.
Aim: To introduce and develop the Differential Calculus as well as the fundamentals of proof technique and rudimentary logic.
Content: Fundamental Concepts - elementary logic, proof techniques. Differential Calculus - Functions, graphs and inverse functions, limits and continuity, the derivative, techniques of differentiation, applications of derivatives, antiderivatives.
Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.
Credit may not be obtained for MATH130 and any of MATH105, 131, 134, 150, 151 or 195.

Mathematics 1A (Eng)
MATH131 H1 P1   (39L-39T-0P-0S-56H-20R-0F-0G-6A-13W-16C)

Prerequisite Requirement: Higher Grade C or Standard Grade A for Matric Mathematics or NSC Level 6 Maths.
Aim: To introduce basic mathematical concepts of differential and integral calculus.
Content: Functions and their graphs, limits and continuity. Differentiation. Application of derivatives to optimisation and curve sketching, linear and quadratic approximation. Indeterminate forms. Inverse trigonometric and other transcendental functions. Indefinite integrals, basic techniques of integration. Definite integrals. Applications in geometry, physics and engineering.
Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.
For Engineering students only.
Credit may not be obtained for MATH131 and any of MATH105, 130, 134, 150, 151 or 195.

Applied Mathematics 1A (Eng)
MATH132 H1 P1   (39L-39T-0P-0S-56H-20R-0F-0G-6A-13W-16C)
Prerequisite Requirement: Higher Grade C or Standard Grade A for Matric Mathematics or NSC Level 6 Maths.
Aim: To introduce basic methods of vector and matrix algebra, statics.
Content: Vectors and Matrices. Determinants. Dot and cross products. Solving simultaneous systems of linear equations. Force vectors in 2D and 3D. Plane statics.
Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.
For Engineering students only.

Quantitative Methods 1
MATH134 H1 P1 W1   (39L-39T-0P-0S-56H-20R-0F-0G-6A-13W-16C)
Prerequisite Requirement: Higher Grade E or Standard Grade B for Matric Mathematics or NSC Level 4 Maths.
Aim: To introduce mathematical techniques for business mathematics and to develop problem solving skills.
Content: Matrices and matrix models. Solution of systems of linear equations and simple linear programming problems. Elements of the mathematics of finance. Differential calculus in one and several variables, applications, partial differentiation, maxima and minima. Exponential and logarithmic functions. Integral calculus with applications. Elementary differential equations.
Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.
Credit may not be obtained for MATH134 and any of MATH105, 130, 131, 150, 151 or 195.

Calculus and Linear Algebra
MATH140 PB WB   (49L-39T-0P-0S-51H-15R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 40% in MATH130 or 195.
Aim: To develop the Integral Calculus and to introduce elementary Linear Algebra.
Content: Integral Calculus - the definite integral, techniques of integration, applications of integrals, Taylor series, polar coordinates, complex numbers. Introduction to Linear Algebra - vectors, lines and planes in space, matrices, systems of linear equations, determinants.
Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.
Credit may not be obtained for MATH140 and any of MATH141, 143, 145 or 196.

Mathematics 1B (Eng)
MATH141 H2 P2   (39L-39T-0P-0S-56H-20R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 40% in MATH131.
Aim: To develop concepts of differential and integral calculus and introduce elements of differential equations and complex numbers theory.
Content: Further techniques of integration. Improper integrals. Further applications of integration. Sequences and series. Taylor expansion. Conic sections. Polar coordinates. Basic differential equations. Complex numbers, basic complex functions.

Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.
Credit may not be obtained for MATH141 and any of MATH140, 143, 145 or 196. For Engineering students only.

Applied Mathematics 1B (Eng)

MATH142 H2 P2 (39L-39T-0P-0S-56H-20R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 40% in (MATH131 and MATH132).
Aim: To provide knowledge about the fundamentals of engineering dynamics.
Content: Kinematics of a particle: Curvilinear motion, normal and tangential acceleration. Newton's 2nd law, motion of body in 3D space. Friction, impulse and conservation of momentum, collisions. Work, energy, power, conservation of energy, applications. Centre of mass, moments of inertia. Plane rotation of rigid bodies.
Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.
For Engineering students only.

Further Mathematics for Natural Sciences

MATH143 P2 (19L-19T-0P-0S-26H-12R-0F-0G-4A-13W-8C)
Prerequisite Requirement: 40% in MATH150.
Aim: To equip students with mathematical tools needed in the life and physical sciences, and to study practical applications of mathematics to these fields.
Content: Functions of Two Variables. Partial Derivatives and applications. Revision of anti-derivatives and definite Integrals. Integrating by substitution, partial fractions, parts. Differential Equations and applications to life and physical sciences. Linear Programming.
Assessment: Class tests and/or assignments (33%); 2 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.
Credit may not be obtained for MATH143 and any of MATH140, 141, 145 or 196.

Operations Research

MATH144 W2 (39L-39T-0P-0S-50H-26R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 40% in MATH130 or 195.
Corequisite: MATH140 or 196.
Aim: To introduce and develop the fundamentals of operations research.
Content: Linear programming, game theory, difference equations, elementary graph theory.
Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.

Further Topics in Mathematics

MATH145 W2 (39L-39T-0P-0S-50H-26R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 40% in MATH150.
Aim: To equip students with mathematical tools needed in the life and physical sciences, and to study practical applications of mathematics to these fields.
Content: Antiderivatives and indefinite integrals. Definite integrals and areas. Techniques of integration (including exponential and trigonometric functions, partial fractions, Taylor Series) and Simpson's rule; applications. Improper integrals; applications. Differential equations and applications to discrete growth processes and exponential growth. Functions of several variables; partial derivatives, maxima and minima; applications. Lagrange multipliers, least squares approximations and applications.
Assessment: Class tests & assignments (33%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.
Credit may not be obtained for MATH145 and any of MATH140, 141, 143 or 196.

Mathematics for Natural Sciences

MATH150 P1 W1   (49L-39T-0P-0S-51H-15R-0F-0G-6A-13W-16C)

Prerequisite Requirement: Higher Grade E or Standard Grade B for Matric or NSC Level 4 Maths.

Aim: To equip students with mathematical tools needed in the life and physical sciences, and to study practical applications of mathematics to these fields.

Content: Basic algebra, solving equations and inequalities, functions and translations. Curve sketching. Binomial theorem. Limits and continuity. Definition and techniques of differentiation (including exponential, log and trigonometric functions). The first derivative test; concavity; the second derivative test; absolute extrema; applications. Basic antiderivatives, Fundamental theorem of Calculus. Matrices, inverse of a matrix, solving systems of linear equations.

Assessment: Class tests and/or assignments (33%); 3 h exam (67%).

DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.

Credit may not be obtained for MATH150 and any of MATH105, 130, 131, 134, 151 or 195.

Mathematics for Natural Sciences(Augmented)

MATH151 P1 W1   (78L-78T-0P-0S-99H-54R-0F-0G-11A-13W-16FC-16DC)

Prerequisite Requirement: Higher Grade E or Standard Grade B for Matric Mathematics or NSC Level 3 Maths; acceptance into BSc4(Augmented).

Aim: To equip students with mathematical tools needed in the life and physical sciences, and to study practical applications of mathematics to these fields.

Content: This module covers the syllabus of MATH150 and, in addition, supplementary material designed for students who are under-prepared for university-level Mathematics. Students are expected to attend additional lectures, tutorials and undergo additional assessment to a maximum of 160 hours.

Assessment: Class tests and/or assignments (33%); 3 h exam (67%).

DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.

Credit may not be obtained for MATH151 and any of MATH105, 130, 131, 134 or 150. This module is worth 16 degree credits and 16 foundation credits.

Foundation Mathematics for Commerce

MATH194 PY WY   (78L-78T-0P-0S-91H-54R-0F-0G-19A-26W-32FC-0DC)

Aim: To provide a foundation for the basic mathematics underpinning mathematical techniques for commerce, and to develop elementary problem solving skills.

Practicals: Real numbers and the real line, the Cartesian plane, straight lines, inequalities, number patterns and sequences, applications to commerce. Exponents and radicals, algebraic expressions, algebraic fractions. Simultaneous equations, systems of linear equations, introduction to simple linear programming, simple problem formulation. Logarithms, elementary mathematics of finance. Introduction to differential calculus with applications to commerce.

Assessment: Class mark (Assignments, Class tests, 3 h June test, and tutorial tests), (50%); 3 h exam. (50%).

DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.

For students in the BCom4 (Access initiative) only.

Introduction to Calculus (Augmented)

MATH195 PY WY   (104L-26T-72P-0S-47H-60R-0F-0G-11A-26W-16FC-16DC)

Prerequisite Requirement: Higher Grade E or Standard Grade B for Matric Mathematics or NSC Level 3 Maths; acceptance into BSc4(Augmented).

Aim: To introduce and develop the Differential Calculus as well as the fundamentals of proof technique and rudimentary logic.

Content: This module covers the syllabus of MATH130 and, in addition, supplementary material designed for students who are under-prepared for university-level Mathematics. Students are expected to attend additional lectures, tutorials and undergo additional assessment to a maximum of 160 hours.

Assessment: Tests/Assignments (50%); 3 hr theory exam (50%).

DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.

Credit may not be obtained for MATH195 and any of MATH105, 130, 131, 134, 150 or 151. This module is worth 16 degree credits and 16 foundational credits.

Calculus and Linear Algebra (Augmented)

MATH196 P2 W2 (78L-78T-0P-0S-99H-54R-0F-0G-11A-13W-16FC-16DC)

Prerequisite Requirement: 40% in MATH195.

Aim: To develop the Integral Calculus and to introduce elementary Linear Algebra.

Content: This module covers the syllabus of MATH140 and, in addition, supplementary material designed for students who are under-prepared for university-level Mathematics. Students are expected to attend additional lectures, tutorials and undergo additional assessment to a maximum of 160 hours.

Assessment: Class tests and assignments (33%); 3 h exam (67%).

DP Requirement: 40% Class mark, 80% attendance at lectures and 80% completion of tutorial requirements.

Credit may not be obtained for MATH196 and any of MATH140, 141, 143 or 145. This module is worth 16 degree credits and 16 foundational credits.

Advanced Calculus & Linear Algebra

MATH212 P1 W1 (49L-39T-0P-0S-47H-19R-0F-0G-6A-13W-16C)

Prerequisite Modules: MATH130 or 195; MATH140 or 196.

Aim: To give a coherent treatment of basic theories & problem solving techniques from Advanced Calculus and Linear Algebra and their applications.

Content: Advanced Calculus: Functions of several variables. Partial derivatives, differentiability, chain rules, implicit differentiation. Extrema and Lagrange multipliers. Multiple integrals, change of variables. Linear algebra: axioms for vector spaces. Linear independence, bases and dimension. Matrices and linear transformations. Change of basis. Eigenvectors and eigenvalues, diagonalization and its applications (including linear differential equations). Orthogonality, Gram-Schmidt process.

Assessment: Class tests and/or assignments (33%); 3 h exam (67%).

DP Requirement: Class record 35%. 80% attendance at lectures and tutorials.

Credit may not be obtained for MATH212 and MATH238.

Mechanics

MATH235 P1 W1 (39L-39T-0P-0S-52H-24R-0F-0G-6A-13W-16C)

Prerequisite Modules: MATH130 or 195; MATH140 or 196.

Aim: To provide the student with a systematic development of advanced applications in mechanics.

Content: Newton's laws of motion and conservation laws. Kepler's laws, central forces and planetary motion. Moving frames and Coriolis forces. Motion of a rigid body and Euler's equations. Lagrange's equations. Introduction to mechanics of continuous media.

Assessment: Class tests and/or assignments (33%); 3 h exam (67%).

DP Requirement: 35% Class mark, 80% attendance at lectures & tutorials.

Discrete Mathematics with Applications

MATH236 P1 W1 (39L-39T-0P-0S-52H-24R-0F-0G-6A-13W-16C)

Prerequisite Modules: MATH130 or 195; MATH140 or 196.

Aim: To study basic concepts of discrete mathematics & applications to cryptology and graph theory.

Content: Basic set theory. Relations & functions, equivalence relations. Counting principles, inclusion-exclusion & pigeonhole principles, combinations, identities with binomial coefficients. Modular arithmetic, basic number theory: GCD, extended Euclidean algorithm, Euler's totient function, basic group theory, Fermat's Little Theorem, Euler's Theorem. Cryptology: encryption, decryption of well-known private-key cryptosystems, cryptanalysis of shift, substitution & Vigenère ciphers, stream ciphers, Shannon theory, public key cryptography, product cryptosystems. Recursions & generating functions.

Assessment: Class mark (33%); 3 h exam (67%).

DP Requirement: 35% Class mark, 80% attendance at lectures & tutorials.

Mathematics 2A (Eng)

MATH238 H1   (39L-39T-0P-0S-52H-24R-0F-0G-6A-13W-16C)

Prerequisite Requirement: 40% in MATH141.

Prerequisite Modules: MATH131.

Aim: To exhaustively cover the methods & applications of multivariable calculus.

Content: Functions of several variables: level curves and surfaces, limits, continuity. Partial derivatives, gradient. Tangent planes and normal lines. Maxima and minima. Constrained functions, Lagrange multipliers. Parametric representation of lines & surfaces; curvature, torsion. Cylindrical & spherical coordinates. Multiple integrals. Line & surface integrals. Applications: centres of mass, moments & products of inertia. The operators grad, div and curl. Green's theorem; divergence theorem; Stokes' theorem. Applications: work, potential energy, conservative fields; flux and diffusion.

Assessment: Class tests and/or assignments (33%); 3 h exam (67%).

DP Requirement: 35% Class mark, 80% attendance at lectures & tutorials.

For Engineering students only. Credit may not be obtained for MATH212 and MATH238.

Applied Finite Mathematics

MATH239 H1   (20L-20T-0P-0S-26H-10R-0F-0G-4A-13W-8C)

Prerequisite Requirement: 40% in MATH131, 141.

Aim: To introduce the student to the theory and methods of finite mathematics.

Content: Logic, Boolean algebra. Set Theory. Difference Equations. Graph Theory. Linear Programming.

Assessment: Class tests and/or assignments (33%); 2 h exam (67%).

DP Requirement: 35% Class mark, 80% attendance at lectures & tutorials.

For Engineering students only.

Intro to Numerical Mathematics

MATH243 P2 W2   (39L-39T-0P-0S-52H-24R-0F-0G-6A-13W-16C)

Prerequisite Modules: MATH130 or 195; MATH140 or 196.

Aim: To provide the student with a knowledge and understanding of fundamental material in numerical methods.

Content: Error analysis, interpolation and polynomial approximation, numerical differentiation and integration, numerical linear algebra. Basic numerical methods in differential equations.

Assessment: Class tests and/or assignments (33%); 3 h exam (67%).

DP Requirement: 35% Class mark, 80% attendance at lectures & tutorials.

Recommended co-requisite: MATH 251.

Mathematical Modelling

MATH246 P2 W2   (39L-39T-0P-0S-52H-24R-0F-0G-6A-13W-16C)

Prerequisite Modules: MATH130 or 195; MATH140 or 196.

Aim: To develop skills to construct and analyse mathematical models of real world situations.

Content: Formulation and construction of mathematical models for real world problems in terms of difference and differential equations. Case studies from finance, population theory, mathematical biology, epidemiology, geometry and mechanics. Relevant properties of difference and differential equations and systems. Basic methods of analysing these models.

Assessment: Class tests and/or assignments (33%); 3 h exam (67%).

DP Requirement: Class record 35%. 80% attendance at lectures and tutorials.

Recommended co-requisite: MATH 251.

Mathematics 2B (Eng)

MATH248 H2   (39L-39T-0P-0S-56H-20R-0F-0G-6A-13W-16C)

Prerequisite Requirement: 40% in MATH238.

Prerequisite Modules: MATH141.

Aim: To exhaustively cover linear differential equations, eigenvalue theory, and to prepare students for more advanced methods.

Content: Laplace transforms. Inversion by partial fractions and basic manipulations. Linear ODE's with constant coefficients, use of Laplace transforms in solving equations & systems. Vector spaces, dimension, basis, linear transformations. Eigenvalues & eigenvectors. Diagonalization. Inner product, projections, orthogonal transformations. Applications. Functions of a complex variable, analytic functions, Cauchy-Riemann equations. Integration. Path independence of integrals, Cauchy-Goursat theorem. Cauchy integral formula; simple applications.

Assessment: Class tests and/or assignments (33%); 3 h exam (67%).

DP Requirement: 35% Class mark, 80% attendance at lectures & tutorials.

For Engineering students only. Credit may not be obtained for MATH248 and MATH251.

Further Calculus and Introductory Analysis

MATH251 P2 W2 (49L-39T-0P-0S-47H-19R-0F-0G-6A-13W-16C)

Prerequisite Modules: 40% in MATH212.

Aim: To provide a foundation for advanced study in mathematics and applied mathematics.

Content: Review of multiple integrals. Vector functions and vector fields, including curl and divergence. Curves, line integrals, path independence, Fundamental Theorem of Line Integrals. Green's Theorem. Surfaces, surface integrals, divergence and Stokes' Theorems. The Completeness Axiom. Sequences and series of real numbers, tests for convergence of series. Linear ordinary differential equations, solution of first and second order equations. Laplace transforms.

Assessment: Class tests (33%); 3 h exam (67%).

DP Requirement: 35% Class mark; 80% attendance at both lectures and tutorials.

Optimisation & Optimal Control Theory

MATH301 P2 W2 (29L-20T-0P-0S-80H-26R-0F-0G-5A-13W-16C)

Prerequisite Modules: MATH212, 251.

Aim: To provide the student with a knowledge and understanding of the theory and tools of optimisation and their applications to optimal control.

Content: The mathematics of control theory focusing on a selection of topics from: n-dimensional unconstrained optimization; n-dimensional constrained optimization & the Kuhn-Tucker conditions. Calculus of variations. Linearquadratic control theory, controllability, observability & stability. Hamiltonian formulation & Pontryagin's principle.

Assessment: Class Tests (33%); 3 h exam (67%).

DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials.

Real Analysis

MATH310 P1 W1 (29L-20T-0P-0S-80H-26R-0F-0G-5A-13W-16C)

Prerequisite Modules: MATH212, 251.

Aim: To introduce and develop in a mathematically rigorous manner, the Riemann integral, sequences and series of functions, and metric spaces.

Content: Upper and lower Riemann integrals, Riemann integrability, properties of the Riemann integral. The fundamental theorem of integral calculus, improper integrals. Sequences and series of functions, uniform convergence, the interchange of limiting processes. Power series, Taylor's theorem. Sets, functions and countability. Metric spaces, continuity and convergence, completions. Fixed point theorems and applications. Compactness.

Assessment: Class tests and/or assignments (33%); 3 h exam (67%).

DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials.

Numerical Analysis

MATH327 P2 W2 (29L-20T-0P-0S-80H-26R-0F-0G-5A-13W-16C)

Prerequisite Requirement: 32C of MATH at Level 2 including MATH212.

Aim: To provide students with a solid foundation in the theory and techniques of Numerical Analysis.

Content: Integration. Orthogonal polynomials and approximation theory. Ordinary differential equations. Partial differential equations and boundary value problems. Convergence and stability analysis.

Assessment: Class tests and/or assignments (33%); 3 h exam (67%).

DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials.
Offered in either Semester 1 or 2.

Operations Research Methods

MATH331 P1   (29L-20T-0P-0S-80H-26R-0F-0G-5A-13W-16C)
Prerequisite Modules: MATH212.
Aim: To acquire knowledge of the theory behind optimisation algorithms and to acquire skills in solving optimisation problems.
Content: Formulation of problems. Simplex method, duality. Integer programming, heuristics. Introduction to nonlinear programming.
Assessment: Tutorial & project work (10%), Class tests (30%); 3 h exam (60%).
DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials.

Advanced Differential Equations

MATH334 P1 W1   (29L-20T-0P-0S-80H-26R-0F-0G-5A-13W-16C)
Prerequisite Modules: MATH212, 251.
Aim: To acquire knowledge of the underlying mathematical theory to solve advanced problems in differential equations.
Content: Phase plane and stability, Poincare-Bendixon theorem, limit cycles, Lyapunov functions. Basic PDE's: the Laplace equation, the wave equation and the heat equation. Canonical forms of PDE's. Methods of solutions: basic separation of variables, method of characteristics, Green's function. Application to problems arising in mathematical physics.
Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials.

Linear Algebra & Coding Theory

MATH338 W1   (29L-20T-0P-0S-80H-26R-0F-0G-5A-13W-16C)
Prerequisite Modules: MATH212, 251.
Aim: To develop advanced techniques in linear algebra and introduce the student to the fundamentals of coding.
Content: Topics from Advanced Linear Algebra and an introduction to Coding Theory.
Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials.

Algebraic Structures

MATH340 P2 W2   (29L-20T-0P-0S-80H-26R-0F-0G-5A-13W-16C)
Prerequisite Modules: MATH212, 251.
Aim: To investigate properties of groups, rings, polynomial rings and fields which are fundamental to Modern Algebra.
Content: Binary operations, equivalence relations, elementary number theory, groups, subgroups, cyclic groups, normal subgroups, quotient groups, isomorphism theorems for groups, permutation groups, groups of small order. Rings, polynomial rings, ideals, prime and maximal ideals. Fields, field of fractions, finite fields, extension fields.
Assessment: Class Tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials.

Graph Theory

MATH342 PC W2   (29L-20T-0P-0S-80H-26R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 32C of MATH at Level 2 including MATH212.
Aim: To explore techniques and algorithms in graph theory.
Content: Aspects of Graph Theory and its applications: Distance, connectivity, matchings, hamiltonicity, eulerian graphs, vertex and edge colourings, network flows.
Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials.

Tensor Analysis
MATH344 W2   (29L-20T-0P-0S-80H-26R-0F-0G-5A-13W-16C)
Prerequisite Modules: MATH212, 251.
Aim: To develop the basic theory of tensors and to study applications in physical theories.
Content: Basic tensor theory with applications to a selection of topics from special relativity, electromagnetic theory, mechanics and thermodynamics.
Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials.

Topics in Analysis
MATH347 W2   (29L-20T-0P-0S-80H-26R-0F-0G-5A-13W-16C)
Prerequisite Requirement: 40% in MATH310.
Aim: To introduce the student to the theory of Hilbert spaces and basic Lebesgue integration.
Content: Inner product spaces and their completion. Geometric theory of Hilbert spaces. Orthonormal basis. Orthogonal polynomials. Standard classes of linear operators in Hilbert spaces. Unbounded operators. Lebesgue integral on the real line. Basic properties of the Lebesgue integral. Lebesgue spaces.
Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials.

Discrete Mathematics
MATH349 H2   (20L-20T-0P-0S-26H-10R-0F-0G-4A-13W-8C)
Prerequisite Requirement: 40 % in MATH239.
Prerequisite Modules: MATH248.
Aim: To provide the students with a knowledge and understanding of discrete mathematics.
Content: Groups, semigroups, finite fields. Finite state machines, linear codes. Further graph theory, Boolean algebra with applications.
Assessment: Class tests and/or assignments (33%); 2 h exam (67%).
DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials. **For Engineering students only.**

Mathematics 3A (Eng)
MATH354 H1   (20L-20T-0P-0S-26H-10R-0F-0G-4A-13W-8C)
Prerequisite Requirement: MATH238, 40% in MATH248.
Aim: To provide the student with essential tools of advanced applied mathematics.
Content: Fourier series, application to boundary value problems for ordinary differential equations (Sturm-Liouville problem). Series solution of ordinary differential equations, basic special functions. Separation of variables for one and two dimensional PDE's. Fourier transform, applications to PDE's. Further complex variable theory, Laurent's and Taylor's theorem, isolated singularities and residues, evaluation of integrals by residues. Applications.
Assessment: Class tests and/or assignments (33%); 2 h exam (67%).
DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials.
For Engineering students only.

Methods of Applied Mathematics
MATH356 P1 W1   (29L-20T-0P-0S-80H-26R-0F-0G-5A-13W-16C)
Prerequisite Modules: MATH212, 251.
Aim: This module discusses techniques and methods necessary for problem solving.
Content: Complex functions and the Cauchy-Riemann conditions. Contour integrals and the Cauchy integral formula. Taylor's theorem, Laurent series and residue theory. Special functions. Theory of Fourier series, applications to series solutions of ordinary differential equations. Integral transform theory. Fourier analysis and applications to partial differential equations.

Assessment: Class tests and/or assignments (33%); 3 h exam (67%).
DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials.

Numerical Methods
MATH360 H2   (20L-20T-0P-0S-26H-10R-0F-0G-4A-13W-8C)
Prerequisite Requirement: 40% in MATH248.
Aim: To provide the student with a knowledge and understanding of basic approximate methods for solving mathematical problems in engineering.
Content: Interpolation, approximate integration, numerical solution to algebraic, ordinary and partial differential equations.
Assessment: Class tests and/or assignments (33%); 2 h exam (67%).
DP Requirement: 30% Class mark, 80% attendance at lectures & tutorials.
For Engineering students only.

Classical Algebra
MATH701 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To develop basic aspects of the theory of classical algebra.
Content: Further group theory; Galois theory; ring theory.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Cosmology
MATH703 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To acquire knowledge of the theory and techniques used in Cosmology.
Content: Robertson-Walker solution and Friedman models; inflation; gravitational waves.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Differential Geometry
MATH704 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To develop basic aspects of the modern theory of Differential Geometry.
Content: Structure of manifolds; Lie algebras; symmetries and application to physics.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Graph Theory 1
MATH707 W1   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To develop basic aspects of the modern Graph Theory.
Content: Digraphs, tournaments, Ramsey theory, graph matchings.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.

Graph Theory 2
MATH708 W2   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Prerequisite Modules: MATH707.
Aim: To further develop Graph Theory.
Content: Distances, vulnerability, colouring and domination in graphs.

Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.

Industrial Mathematics

MATH709 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To study mathematical models applied to industry.
Content: Selected case studies from industrial practice involving precipitation of crystals, electron beam lithography, pollution spreading, photocopier machine and others. Modelling from first principles, theoretical analysis of models, basic numerical procedures.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Set Theory & Logic

MATH710 PC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Prerequisite Requirement: Any Level 3 Mathematics module.
Prerequisite Modules: MATH212.
Aim: This module provides mathematical treatment of the basic ideas and results from set theory and logic. It places emphasis on the axiomatic approach to set theory, the semantic and syntactic interaction in mathematical languages. It is suitable for students registered in Mathematics Honours programmes and those from Computer Sciences.
Content: Propositional Logic. First order logic. Zermelo-Fraenkel set theory with axiom of choice. Cardinal arithmetic. Gödel's completeness and Incompleteness theorem. Compactness theorem. Undecidability. Introductory model theory.
Assessment: Assignments (33%); 3 h exam (67%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Classical Mechanics

MATH712 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To acquire knowledge of the theory and techniques used in Classical Mechanics.
Content: Calculus of variations; Lagrangian and Hamiltonian mechanics; canonical transformations and HamiltonJacobi theory; conservation laws; Lie algebras; Liouville's theorem and integrable systems; configurational invariants and almost complete integrability.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Number Theory

MATH713 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To develop basic aspects of Number Theory.
Content: Introduction to algebraic number theory, quadratic residues, quadratic and cyclotomic fields, factorization, geometric methods, applications.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Ordinary Differential Equations

MATH714 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To develop basic aspects of the modern theory of Ordinary Differential Equations.
Content: Historical introduction; symmetry; Lie symmetries; differential equations and symmetry; classification of equations; solution of equations; algebras of integrals; partial differential equations; systems of equations; generalized symmetries; Noether's theorem.

Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Partial Differential Equations
MATH716 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To acquire knowledge of the theory and techniques used in Partial Differential Equations.
Content: First order equations, classification and solutions of second order equations, Cauchy-Kovalevskaya theorem, systems of equations, shocks.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

General Relativity
MATH718 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To acquire knowledge of the theory and techniques used in General Relativity.
Content: Curvature and Einstein field equations; Schwarzschild solution and black holes.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Set Theory & Ordered Sets
MATH719 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To develop basic aspects of the Axiomatic Set Theory and related topics.
Content: Axiomatic set theory, ordinal and cardinal arithmetic, axiom of choice. Order, lattices, closure systems.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Topology
MATH721 PC WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To develop basic aspects of the theory of topology.
Content: An introduction to general topology: separation, countability, metrizability. A selection of topics from general and algebraic topology.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Foundations
MATH722 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To provide and develop the foundations of mathematics.
Content: Propositional and first order logic; completeness, compactness.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Universal Algebra
MATH723 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To provide and develop basic theory of Universal Algebra.
Content: Algebras, congruences, varieties and quasivarieties, congruence modularity and distributivity, axiomatization.

Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Cryptography
MATH724 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To develop basic aspects of the modern theory of Cryptography.
Content: Entropy, block ciphers, stream ciphers, public key systems, signature schemes, key management.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Coding Theory
MATH726 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To develop basic aspects of modern Coding Theory.
Content: Introduction to field theory and design theory. Linear, cyclic, Hamming, Hadamard, Golay and BCH codes.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Special Topics A
MATH727 PC WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To acquire knowledge of and skills in a recent topic in Pure or Applied Mathematics.
Content: Topics in mathematics or applied mathematics, not included in the list of specified modules or additional aspects of the listed modules may be offered.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Applied Analysis
MATH728 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To introduce an up-to-date mathematical theory of the applications of abstract analysis.
Content: Basic topological and metric notions. Uniform convergence and interchangeability of limiting processes.
Banach fixed point theorem with applications. Implicit and inverse function theorems.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Special Topics B
MATH729 PC WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To acquire further knowledge of and skills in a recent topic in Pure or Applied Mathematics.
Content: Further topics in mathematics or applied mathematics, not included in the list of specified modules or additional aspects of the listed modules may be offered.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Computability Theory
MATH730 PC   (27L-0T-0P-0S-103H-25R-0F-0G-5A-13W-16C)
Prerequisite Requirement: Any Level 3 Mathematics module. MATH710 is recommended.

Prerequisite Modules: MATH212.
Aim: To introduce an up-to-date mathematical theory of Computable Functions and Computability.
Content: Basic logic. Turing machines. Church's thesis. Computability. Universal machines. Lambda calculus. The Halting Problem. Gödel's incompleteness theorem. Undefinability of Truth. Recursion theorem. Recursively enumerable sets. Simple sets; Two of the following topics: Turing degree and jump operator; arithmetical hierarchy; recursive ordinals; Hilbert's Tenth Problem.
Assessment: Assignments (33%); 3 h exam (67%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Mathematical Biology
MATH731 PC WC   (29L-10T-0P-0S-97H-18R-0F-0G-6A-13W-16C)
Aim: To provide an introduction to Mathematical Biology with an emphasis on applications.
Content: Continuous and discrete models for single and interacting species. Mathematical bioeconomics. A selection of topics chosen from pattern formation, nerve impulses, epidemiology, heartbeat dynamics, tumour growth.
Assessment: Tests and assignments (30%); 3 h exam (70%).
DP Requirement: 80% attendance, 40% coursework.
Offered in either Semester 1 or 2.

Fluid Dynamics
MATH732 PC WC   (29L-10T-0P-0S-97H-18R-0F-0G-6A-13W-16C)
Prerequisite Modules: MATH334.
Aim: To provide students with a first introduction to theoretical fluid mechanics and its applications.
Content: The continuum approach. Modelling of fluids; Eulerian and Lagrangian approaches. The material derivative and equations of motion of inviscid fluids Vorticity, circulation and irrotational flows. The complex potential, Kutta condition, lift and drag. Introduction to viscous fluid flows; Navier-Stokes equations.
Assessment: Tests and assignments (30%); 3 h exam (70%).
DP Requirement: 80% attendance, 40% Class mark.
Offered in either Semester 1 or 2.

Applied Numerical Analysis
MATH733 PC   (29L-10T-0P-0S-97H-18R-0F-0G-6A-13W-16C)
Prerequisite Modules: MATH327.
Aim: To provide numerical techniques and analysis for methods applied in some practical problems.
Content: Iterative techniques for large systems of linear equations; relaxation methods, cg- method, Krylov-space methods, convergence. Eigenvalue problems. Numerical techniques for stiff and non-stiff systems of ordinary differential equations; explicit schemes, implicit schemes, sensitivity analysis. Numerical methods for boundary value problems.
Assessment: Tests and assignments (30%); 3 h exam (70%).
DP Requirement: 80% attendance, 40% Class mark.
Offered in either Semester 1 or 2.

Analytic Methods in Partial Differential Eqns
MATH734 PC   (29L-10T-0P-0S-97H-18R-0F-0G-6A-13W-16C)
Prerequisite Modules: MATH334.
Aim: To acquire knowledge of techniques used in partial differential equations and their applications.
Content: Modelling with partial differential equations. Hyperbolic problems; conservation laws, wave equations in general domains, systems of equations. Laplace Equations; maximum/minimum principle, variational formulation, Green's function for different domains. Parabolic Equations; initial boundary value problems.
Assessment: Tests and assignments (30%); 3 h exam (70%).

DP Requirement: 80% attendance, 40% Class mark.
Offered in either Semester 1 or Semester 2.

Further Graph Theory

MATH740 PC WC   (27L-0T-0P-0S-108H-22R-0F-0G-3A-13W-16C)
Prerequisite Modules: MATH342.
Aim: To further develop Graph Theory.
Content: Colourings. Connectivity. Domination in graphs. Extremal graph theory. Graph algorithms and complexity theory. Hamiltonicity. Matchings. Vertex covers. Planar graphs. Probabilistic methods in graph theory. Ramsey theory.
Assessment: Assignments (33%); 3 h exam (67%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Financial Mathematics

MATH741 PC WC   (29L-10T-0P-0S-97H-18R-0F-0G-6A-13W-16C)
Aim: To acquire knowledge of Markowitz mean variance portfolio theory and its implementation.
Content: Mean variance portfolio theory. Efficient portfolios. Efficient frontier. Single and multiple index models. International diversification. Capital asset pricing models. Arbitrage pricing model. Efficient markets. Evaluation of portfolio performance. Options and futures.
Assessment: 2 projects (50%); 3 h exam (50%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Algorithms & Complexity

MATH745 PC WC   (30L-0T-0P-0S-111H-14R-0F-0G-5A-13W-16C)
Prerequisite Requirement: A degree in a mathematical science.
Prerequisite Modules: MATH212, 251.
Aim: Advanced understanding of and facility in the correctness and complexity of algorithms.
Content: Basic algorithmic analysis techniques. Algorithmic strategies. Graph Algorithms. Complexity classes, P and NP. A miscellany of advanced topics.
Assessment: Test & assignments (30%); 3 h exam (70%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Further Group Theory

MATH751 PC WC   (27L-0T-0P-0S-108H-22R-0F-0G-3A-13W-16C)
Prerequisite Modules: MATH340.
Aim: To develop further the Theory of Groups.
Content: Permutation groups, simplicity of A_n, groups of small order, permutation representations, p-groups, Sylow theorems, normal series, solvable and nilpotent groups, finite direct products, basis theorem, fundamental theorem of finite abelian groups, general linear group, some simple groups.
Assessment: Assignments (33%); 3 h exam (67%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Recent Topics in Mathematics I

MATH753 PC WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To acquire knowledge of and skills in a recent topic in Mathematics.
Content: Will vary according to the most recent developments in Mathematics.
Assessment: Project (30%); 3 h exam (70%).

DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Applied Optimal Control Theory
MATH755 PC WC   (29L-10T-0P-0S-97H-18R-0F-0G-6A-13W-16C)
Aim: To provide an introduction to optimal control with an emphasis on applications.
Content: Basic concepts. Controllability, observability, stability. Variational methods. Bang-bang control. Maximum principle. Dynamic programming. Numerical techniques.
Assessment: Tests and assignments (30%); 3 h exam (70%).
DP Requirement: 80% attendance, 40% Class mark.
Offered in either Semester 1 or 2.

Recent Topics in Mathematics II
MATH761 P2   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To acquire knowledge of and skills in a recent topic in Mathematics.
Content: Will vary according to the most recent developments in Mathematics.
Assessment: Project (30%); 3 h exam (70%).
DP Requirement: 80% attendance.

Representation Theory
MATH762 PC WC   (27L-0T-0P-0S-108H-22R-0F-0G-3A-13W-16C)
Prerequisite Modules: MATH340.
Corequisite: MATH751.
Aim: To introduce and develop the theory of Group Representations.
Content: Basic concepts of representation theory. Characters. Maschke's theorem, Schur's lemma. Ordinary characters of finite groups. Regular representation. Algebraic integers. Group algebras. Orthogonality relations. Character tables. Tensor products and product of characters. Restriction and induction of representations and characters. The Frobenius reciprocity law. Normal subgroups and lifted characters. Clifford theorem. Inertia subgroups. Burnside's paqb theorem.
Assessment: Assignments (33%); 3 h exam (67%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Further Ring Theory
MATH763 PC WC   (27L-0T-0P-0S-108H-22R-0F-0G-3A-13W-16C)
Prerequisite Modules: MATH340.
Corequisite: MATH771.
Aim: To develop further the theory of Rings and Modules.
Content: Ordered structures, one-sided and two-sided ideals, modules and submodules, Isomorphism Theorems, composition series and chain conditions, simple primitive and prime rings, the prime and Jacobson radicals, semisimple modules and the Wedderburn-Artin Theorem, Artinian and Noetherian rings, injective and projective modules, localization and rings of quotients.
Assessment: Assignments (33%); 3 h exam (67%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Advanced Optimisation
MATH765 PC WC   (29L-10T-0P-0S-97H-18R-0F-0G-6A-13W-16C)
Prerequisite Requirement: Programming skills.
Prerequisite Modules: MATH331.

Aim: To acquire knowledge of advanced techniques in Optimisation.
Content: Advanced topics in linear programming, mixed integer programming and nonlinear programming.
Assessment: Tests and assignments (30%); 3 h exam (70%).
DP Requirement: 80% attendance, 40% Class mark.
Offered in either Semester 1 or 2.

Rings & Fields
MATH771 PC WC   (27L-0T-0P-0S-108H-22R-0F-0G-3A-13W-16C)
Prerequisite Modules: MATH340.
Aim: To develop basic aspects of the theory of rings, fields and other algebraic structures.
Content: Topics will be chosen from: Ideals, localization, polynomial rings, basic module theory, field extensions and Galois theory.
Assessment: Assignments (33%); 3 h exam (67%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Topics in Topology
MATH777 W2   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Prerequisite Modules: MATH721.
Aim: To develop further topics in Topology.
Content: Depending on interest, topics will be chosen from advanced general topology, theory of locales or algebraic topology.
Assessment: Tests (33%); 3 h exam (67%).
DP Requirement: 80% attendance.

Numerical Analysis I
MATH778 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To acquire knowledge of the theory and techniques used in basic Numerical Analysis.
Content: Review of functional analysis, the matrix eigenvalue problem, the linear inverse problem, advanced methods on numerical solutions of differential equations.
Assessment: Tests (33%); 3 h exam (67%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Measure and Integration I
MATH783 PC WC   (29L-10T-
0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To develop basic aspects of the modern theory of Measure and Integration.
Content: Lebesgue measure, Lebesgue integral, convergence theorems, Lebesgue's differentiation theorem.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Measure and Integration II
MATH784 P2 W2   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Prerequisite Modules: MATH783.
Aim: To further develop the modern theory of Measure and Integration.
Content: Abstract measure spaces, Lp spaces, convergence, the Radon-Nikodym theorem, Fubini's theorem, other special topics.
Assessment: 3 h exam (100%).

DP Requirement: 80% attendance.
Offered in Semester 2 provided MATH783 has been offered in Semester 1.

Functional Analysis I
MATH785 PC WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To develop basic aspects of the modern theory of Functional Analysis.
Content: Normed spaces and Banach spaces, linear operators, Hilbert spaces, fundamental theorems for normed and Banach spaces.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Functional Analysis II
MATH786 W2   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Prerequisite Modules: MATH785.
Aim: To further develop the concepts of Functional Analysis.
Content: Compact linear operators, Banach algebras, spectral theory for bounded self-adjoint operators, other special topics.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in Semester 2 provided MATH785 has been offered in Semester 1.

Numerical Analysis II
MATH792 W2   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Prerequisite Modules: MATH778.
Aim: To develop further topics in Numerical Analysis.
Content: The non-linear inverse problem, approximation theory, other topics.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in Semester 2 provided MATH778 has been offered in Semester 1.

Optimisation I
MATH793 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To acquire knowledge of the theory and techniques used in basic Optimization.
Content: A selection of topics in linear and non-linear optimisation.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Optimisation II
MATH794 W2   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Prerequisite Modules: MATH793.
Aim: To develop further topics in Optimization.
Content: A selection of advanced topics in linear and non-linear optimisation.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.

Financial Mathematics I
MATH795 WC   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Aim: To acquire basic knowledge of the theory and techniques used in Financial Mathematics.

Content: Introduction to forward, futures, and options. Modelling of stock prices, Ito's lemma, the Black-Scholes equation and pricing derivatives.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in either Semester 1 or 2.

Financial Mathematics II

MATH796 W2   (29L-10T-0P-0S-100H-18R-0F-0G-3A-13W-16C)
Prerequisite Modules: MATH795.
Aim: To acquire further knowledge of the theory and techniques used in Financial Mathematics.
Content: Review of stochastic calculus, further option theory, Interest rates derivatives.
Assessment: 3 h exam (100%).
DP Requirement: 80% attendance.
Offered in Semester 2 provided MATH795 has been offered in Semester 1.

Honours Project in Applied Mathematics

MATH798 P2 W2   (0L-20T-0P-4S-296H-0R-0F-0G-0A-13W-32C)
Aim: To acquire experience and skills in the problem-solving process from problem formulation through to policy formulation.
Content: Some aspect of applied mathematics is considered under the guidance of a "supervisor", a report is written and an oral presentation given, both of which are graded. It could be a survey, a synthesis or an application of a known method to a new problem. Original research is not expected but the appropriate research methodology is demanded.
Assessment: Report (80%), oral presentation (20%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Honours Project in Mathematics

MATH799 P2 W2   (0L-20T-0P-4S-296H-0R-0F-0G-0A-13W-32C)
Aim: To gain an ability to read and understand modern mathematical texts; to study in depth a topic in Mathematics.
Content: Some aspect of mathematics is considered under the guidance of a "supervisor", a report is written and an oral presentation given, both of which are graded. It could be a survey, a synthesis or an application of a known method to a new problem. Original research is not expected but the appropriate research methodology is demanded.
Assessment: Report (80%), oral presentation (20%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Combinatorics

MATH811 WC   (26L-26T-0P-26S-60H-16R-0F-0G-6A-13W-16C)
Aim: To provide students with knowledge of modern combinatorics at a level allowing them to read advanced research papers and undertake their own research.
Content: Enumerative combinatorics: elementary counting principles, recurrence relations, generating functions, derangements. Advanced graph theory: trees, connectivity, colourings, Hamiltonian and Eulerian graphs. Introduction to combinatorial optimization: P, NP, NP-completeness, Hamiltonian circuits, clique, knapsack problem.
Assessment: Continuous assessment (100%), including up to two tests (50%) and assignments (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary examination.

Topology

MATH812 WC   (26L-26T-0P-26S-60H-16R-0F-0G-6A-13W-16C)
Aim: To provide students with knowledge of modern topology at a level allowing them to read advanced research papers and undertake their own research.

Content: Advanced point-set topology. Filters and ultrafilters. Tychonoff's Theorem. Compactifications, Proper mappings. Paracompact spaces and Stone's Theorem. Connectedness and local connectedness. Components and quasi-components. Uniform spaces and their completion. Homotopy. The fundamental group of the circle with applications.
Assessment: Continuous assessment (100%), including up to two tests (50%) and assignments (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary examination.

Group Theory
MATH813 WC   (26L-26T-0P-26S-60H-16R-0F-0G-6A-13W-16C)
Aim: To provide students with knowledge of modern group theory at a level allowing them to read advanced research papers and undertake their own research.
Content: Revision. Group actions: orbits, stabilisers, permutation groups, permutation representation. Applications of group actions. Group products. Further topics including free groups, composition series and composition factors, commutators, soluble groups, Hall's Theorem, Nilpotent groups, Frattini subgroups.
Assessment: Continuous assessment (100%), including up to two tests (50%) and assignments (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary examination.

Advanced Analysis
MATH814 WC   (26L-26T-0P-26S-60H-16R-0F-0G-6A-13W-16C)
Aim: To provide students with knowledge of modern analysis at a level allowing them to read advanced research papers and undertake their own research.
Content: Review, interchangeability of limits. A choice of Banach and Hilbert space techniques. (e.g. Baire's category arguments, Ascoli-Arzela theorem, etc). Calculus in Banach spaces. Topics from complex analysis: harmonic functions, maximum modulus principle, analytic continuation.
Assessment: Continuous assessment (100%), including up to two tests (50%) and assignments (50%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary examination.

Recent Topics in Discrete Maths
MATH815 WC   (13L-0T-0P-52S-79H-16R-0F-0G-0A-13W-16C)
Prerequisite Modules: MATH811, MATH812, MATH813, MATH814.
Aim: To develop basic research skills in Discrete Mathematics by offering students opportunities to formulate research questions, perform critical literature search, obtain own research results and present them at a critical discussion forum.
Content: Selected topics in discrete mathematics.
Assessment: Continuous assessment of the presentation of the research topic (100%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary examination.

Recent Topics in Analysis
MATH816 WC   (13L-0T-0P-52S-79H-16R-0F-0G-0A-13W-16C)
Prerequisite Modules: MATH811, MATH812, MATH813, MATH814.
Aim: To develop basic research skills in Analysis by offering students opportunities to formulate research questions, perform critical literature search, obtain own research results and present them at a critical discussion forum.
Content: Selected topics in analysis.
Assessment: Continuous assessment of the presentation of the research topic (100%).
DP Requirement: Not applicable.
Offered in either Semester 1 or Semester 2. This module has no supplementary examination.

Recent Topics in Algebra & Foundations

MATH817 WC (13L-0T-0P-52S-79H-16R-0F-0G-0A-13W-16C)

Prerequisite Modules: MATH811, MATH812, MATH813, MATH814.

Aim: To develop basic research skills in Algebra and the foundations of mathematics by offering students opportunities to formulate research questions, perform critical literature search, obtain own research results and present them at a critical discussion forum.

Content: Selected topics in algebra.

Assessment: Continuous assessment of the presentation of the research topic (100%).

DP Requirement: Not applicable.

Offered in either Semester 1 or Semester 2. This module has no supplementary examination.

Recent Topics in Topology

MATH818 WC (13L-0T-0P-52S-79H-16R-0F-0G-0A-13W-16C)

Prerequisite Modules: MATH811, MATH812, MATH813, MATH814.

Aim: To develop basic research skills in Topology by offering students opportunities to formulate research questions, perform critical literature search, obtain own research results and present them at a critical discussion forum.

Content: Selected topics in topology.

Assessment: Continuous assessment of the presentation of the research topic (100%).

DP Requirement: Not applicable.

Offered in either Semester 1 or Semester 2. This module has no supplementary examination.

Maths Dissertation

MATH819 WY (0L-0T-0P-36S-900H-20R-0F-0G-4A-48W-96C)

Prerequisite Modules: MATH811, MATH812, MATH813, MATH814, and two of (MATH815, MATH816, MATH817, MATH818).

Aim: To give students experience in developing and executing an independent research project in mathematics.

Content: Selection of broad research topic. Literature search. Specifying detailed research questions. Independent research work and presentation of partial results at research work groups, writing dissertation.

Assessment: External examination and oral presentation of the dissertation (100%).

DP Requirement: Not applicable.

Year-long module. This module has no supplementary examination.

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Microbiology

Offered in the School of Life Sciences

Bacteriology

MICR213 P1 W1 (39L-10T-36P-0S-46H-24R-0F-0G-5A-13W-16C)

Prerequisite Modules: (BIOL101 or BIMI120); CHEM110

Aim: To provide a strong foundation in the field of bacteriology.

Content: Morphology and ultra-structure of bacteria; relationship of cellular structure to function. Physiological nutritional groups among the bacteria. Cultivation of bacteria and elementary aspects of control of microorganisms. Introduction to microbial ecology and habitat specific species. Basic aspects of environmental microbiology. Metabolic pathways of industrial importance. Introduction to classification of bacteria.

Practicals: Handling bacteria; aseptic technique; cultural practices; staining procedures; microscopy.

Assessment: Theory tests (10%), assignments and practical tests (10%), laboratory and practical reports (20%); 3 h exam (60%).

DP Requirement: Class mark of 40%. Attendance at 80% of practicals.

Entry to this module may be restricted to students that are registered for a major or programme in which this module is specifically listed as core or as a core elective.

Introductory Food Microbiology
MICR214 P2   (18L-6T-18P-0S-22H-12R-0F-0G-4A-13W-8C)
Prerequisite Modules: (BIOL101 or BIMI120); CHEM110.
Aim: To provide concepts and applications in food microbiology.
Content: The morphology, physiology and classification of microorganisms. Aspects of food, dairy and water microbiology including food safety and preservation as well as aspects of production hygiene and disinfection. Use of microorganisms in the production of selected fermented food and dairy products and their nutritional enhancement. Methods of preventing food spoilage and food poisoning as well as principles of food safety. Selected topics in foodorientated industrial microbiology applications.
Practicals: Laboratory exercises in selected topics.
Assessment: Tests and assignments (20%), prac reports (20%); 2 h exam (60%).
DP Requirement: Class mark of 40%. Attendance at 80% of practicals.

Introduction to Fungi and Viruses
MICR215 W2   (36L-6T-36P-0S-53H-24R-0F-0G-5A-13W-16C)
Prerequisite Modules: (BIOL101 or BIMI120); MICR213.
Corequisite: RDNA202.
Aim: To introduce the fundamental aspects of fungi and viruses (classification, structure, defining characteristics, lifecycles).
Content: Importance of fungi and viruses. General characteristics of fungi and viruses. Principles and practice of fungal and viral taxonomy. Virus replication.
Practicals: Microscopy. Isolation, purification and identification of fungal cultures. An introduction to the techniques used to detect, cultivate and enumerate viruses.
Assessment: Theory tests and tutorials (20%), practical tests and reports (20%); 3 h exam (60%).
DP Requirement: Class mark of 40%. Attendance at 80% of practicals and 100% of tests.
Entry to this module may be restricted to students that are registered for a major or programme in which this module is specifically listed as core or as a core elective.

Introductory Microbial Ecology
MICR220 P2   (18L-6T-18P-0S-22H-12R-0F-4G-0A-6W-8C)
Prerequisite Modules: (BIOL101 or BIMI120), CHEM110.
Aim: To provide key concepts and application in the area of microbial ecology.
Content: Introduction to basic microbial ecology principles: microorganisms in their natural habitats; the microhabitat concept; microbe-microbe and microbe-host interactions; parasitism and symbiosis. Selected topics in applied environmental microbiology including: biogeochemical cycling of elements, bioremediation of polluted soils, eutrophication and microbiological treatment of polluted water, microbiological aspects of composting and silage making, mycorrhizal associations, rumen microbiology.
Practicals: Laboratory exercises in selected topics from the above.
Assessment: Tests and assignments (20%), prac reports (20%); 2 h exam (60%).
DP Requirement: Class mark of 40%. Attendance at 80% of practicals.

Microbial Processing
MICR304 P2 W2   (30L-7T-39P-0S-55H-24R-0F-0G-5A-13W-16C)
Prerequisite Modules: MICR213, RDNA202.
Aim: To introduce the key concepts & applications in microbial bioprocessing.
Content: Range and scope of microbial bioprocessing. Growth of microbes in a controlled environment, including nutrient requirements, kinetics, environmental parameters, and monitoring. Batch & continuous bioprocesses. Aspects of upstream and downstream processing. Examples of major fermentation processes. Current trends and applications in industrial biotechnology. Regulatory, safety (Hazard Analysis Critical Control Point) and socio-economic consideration of biotechnology.
Practicals: Related laboratory work. Field trips to facilities employing microbiological processes.

Assessment: Theory tests, assignments and tutorials (25%), practical tests and reports (25%); 3 h exam (50%).
DP Requirement: Class mark of 40%. Attendance at 80% of practicals.

Advanced Applications of Fungi and Viruses

MICR306 W2   (30L-7T-39P-0S-55H-24R-0F-0G-5A-13W-16C)
Prerequisite Modules: MICR215, RDNA202.
Aim: To introduce advanced aspects and applications of fungi and viruses relevant to microbial biotechnology.
Content: Environmental factors in growth & reproduction. Fungal and viral ecology. Fungal and viral genetics: mechanisms of variability. Applied mycology and virology, fungal and viral diseases and their biological control strategies.
Practicals: Colonisation of buried cellophane, environmental factors in fungal growth. Mycostasis. Isolation and identification of fungal cultures from seeds. Identification and characterization of viruses.
Assessment: Theory Tests & assignments (25%), practical tests, laboratory and practical reports (25%); 3 h exam (50%).
DP Requirement: Class mark of 40%. Attendance at 80% of practicals and 100% of tests.

Environmental Microbial Biotechnology

MICR307 P1 W1   (30L-7T-39P-0S-55H-24R-0F-0G-5A-13W-16C)
Prerequisite Modules: MICR213.
Aim: To provide essential knowledge relevant to industry in the area of biotechnological processes involving microorganisms.
Content: Pollution microbiology. Sources & consequences of pollution. Methods for pollutant detection. Strategies for the treatment of solid & liquid wastes. Water & wastewater quality monitoring. Catabolism of pollutants. Applications, evaluation & biochemical processes. Assessment of microbial diversity in biotechnological processes. Microbial biotechnology for mineral & energy production.
Practicals: Mini-research projects in selected topics from the above. Field trips to facilities using environmental microbial biotechnology.
Assessment: Theory tests and assignments (25%), assessment of practical and project reports (25%); 3 h exam (50%).
DP Requirement: Class mark of 40%. Attendance at 80% of practicals and tutorials and 100% of class tests and field trip (if applicable).

Advanced Bacteriology

MICR311 W1   (30L-7T-39P-0S-55H-24R-0F-0G-5A-13W-16C)
Prerequisite Modules: MICR213.
Aim: To introduce students to advanced topics in bacteriology.
Content: Study of bacterial prokaryotic diversity and techniques involved in elucidating their diversity. Bacterial genetic variation and horizontal gene transfer. Bacterial taxonomy and the principles and practice of bacterial classification. Selected topics in sociomicrobiology, biofilms, and antimicrobial resistance.
Practicals: Identification of unknown bacterial cultures using phenotypic, biochemical and molecular techniques, and dichotomous keys. Establishing and examining biofilms.
Assessment: Theory tests and tutorials (25%), practical assessments, practical assignment and poster presentation (25%), 3 h exam (50%).
DP Requirement: Class mark of 40%. Attendance at 80% of practicals, 100% of tests and tutorials.

Advanced Microbial Metabolism & Ecophysiology

MICR320 P1   (30L-7T-39P-0S-55H-24R-0F-0G-5A-13W-16C)
Prerequisite Modules: MICR213; (BIOC201 or CHEM220).
Aim: To study microbial physiology and metabolism in natural ecosystems and industrial environments.

Content: Review of microbial metabolism and energy generation under aerobic and anaerobic conditions. Ecophysiological versatility of eu- and archaebacteria and environmental impact of microbial activity. Thermodynamic aspects and regulation of microbial catabolism and biotechnological applications thereof.
Practicals: Experiments on microbial metabolism (e-donors, e-acceptors, regulation, secondary metabolites) and ecophysiology. Laboratory-scale industrial microbiology processes. Excursions.
Assessment: Tests and assignments (20%), prac reports (20%); 3 h exam (60%).
DP Requirement: Class mark of 40%. Attendance at 80% of practicals.

Death & Control of Micro-organisms
MICR360 P2   (30L-7T-36P-0S-58H-24R-0F-0G-5A-13W-16C)
Prerequisite Modules: MICR213.
Aim: To study the procedures available to kill or control undesirable microbes.
Content: Death and decline in microbial populations. Enzymes in cellular defence mechanisms. Structure of cells in relation to resistance. Methods of removing undesirable micro-organisms. Applications of chemotherapeutic compounds, disinfectants and germicides. Plasmids in microbial drug resistance. Recovery mechanisms in chemically- and UV-damaged bacteria.
Practicals: Assessing various physical and chemical antimicrobial agents, the effect of environmental factors on the killing/inhibitory activity of selected antimicrobials.
Assessment: 2 Tests (20%), prac reports and performance in tutorials (20%); 3 h exam (60%).
DP Requirement: Class mark of 40%. Attendance at 80% of practicals.

Specialised Microbial Molecular Techniques
MICR701 W1   (20L-20T-60P-0S-44H-10R-0F-0G-6A-8W-16C)
Aim: To familiarize students with selected advanced practical techniques in Microbiology and Microbial Molecular Biology.
Content: Media and reagent preparation, preservation of cultures. Isolation of bacterial genomic and plasmid DNA. Agarose gel electrophoresis. Restriction analysis. Non-radioactive labelling and detection. Southern hybridization.
Preparation of competent cells. Transformation of bacterial cells with plasmid DNA. DNA fingerprinting techniques (PFGE, AFLP, DGGE), PCR, protein analysis, SDS-PAGE, 2D-PAGE. Documentation and analysis of DNA and protein gels. Bioinformatics, biostatistics, electron microscopy, analytical techniques (HPLC, GC-MS). Scientific writing and reading.
Assessment: Practical and theory tests (60%), oral exam (40%).
DP Requirement: Attendance at 80% of lectures, practicals and tutorials and 100% of tests.

Research Project
MICR710 PY WY   (0L-45T-200P-30S-205H-0R-0F-0G-0A-26W-48C)
Prerequisite Modules: MICR701.
Aim: To provide a grounding in research techniques & procedures in Microbiology.
Content: Students have an opportunity to obtain some degree of specialization in: Agricultural Biotechnology, Medical Biotechnology or Industrial and Environmental Microbiology & Biotechnology. In addition to the above, seminars and a research proposal, relevant to the research project are presented to the staff and students. The findings of the research project are submitted in the form of a bound mini-dissertation and also presented at a scientific forum.
Assessment: Project Report (70%), literature review, proposal presentation and research paper (20%), conference presentation (10%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam.

Bacteriology
MICR711 W1   (24L-24T-0P-10S-66H-30R-0F-0G-6A-13W-16C)
Aim: To train students to critically evaluate recent peer-reviewed publications in Bacteriology.
Content: Topics pertinent to the ever expanding field of Bacteriology.

Assessment: Test (25%), performance in tutorials (15%), seminars (10%); 3 h exam (50%).
DP Requirement: Attendance at 80% of tutorials and 100% of tests.

Mycology
MICR712 W1   (24L-24T-0P-10S-66H-30R-0F-0G-6A-13W-16C)
Aim: To train students to critically evaluate recent peer-reviewed publications in Mycology.
Content: Topics pertinent to latest developments in Mycology.
Assessment: Test (25%), performance in tutorials (15%), seminars (10%); 3 h exam (50%).
DP Requirement: Attendance at 80% of tutorials and 100% of tests.

Molecular Genetics
MICR713 W2   (24L-24T-0P-10S-66H-30R-0F-0G-6A-13W-16C)
Aim: To train students to critically evaluate recent peer-reviewed publications in Molecular Genetics.
Content: Coverage of current publications in molecular genetics.
Assessment: Test (25%), performance in tutorials (15%), seminars (10%); 3 h exam (50%).
DP Requirement: Attendance at 80% of tutorials and 100% of tests.

Biotechnology
MICR719 W2   (24L-24T-0P-10S-68H-30R-0F-0G-4A-13W-16C)
Aim: To train students to critically evaluate recent peer-reviewed publications in Biotechnology.
Content: Advances in biotechnology principles and biotechnological applications.
Assessment: Test (25%), performance in tutorials (15%), seminars (10%); 3 h exam (50%).
DP Requirement: Attendance at 80% of tutorials and 100% of tests.

Microbiology Research Skills
MICR721 P1   (10L-15T-70P-0S-45H-5R-0F-10G-5A-13W-16C)
Aim: To introduce students to a laboratory research environment and to provide skills for planning, implementing, analysing and interpreting research in Microbiology.
Content: Good laboratory practice. Experimental design. Selection and evaluation of research methods. Hands-on exposure to a range of standard and sophisticated techniques pertinent to the discipline of Microbiology. Qualitative and quantitative analysis. Interpretation of experimental data.
Practicals: Mini-projects, workshops.
Assessment: Tests (25%), oral presentation (25%) and assignments (50%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Fermentation Microbiology
MICR722 P2   (29L-10T-24P-2S-65H-15R-0F-10G-5A-13W-16C)
Aim: To provide the skills required in establishing and maintaining an industrial microbiological process.
Content: Screening and selection procedures for strain improvement. Scale-up; maintenance of sterility and foam control. Bioreactor design - production methods; batch, fed-batch and continuous culture processes. Immobilisation of whole cells. Selection, preparation and pre-treatment of feedstocks. Product recovery, downstream processing and waste treatment.
Practicals: Field trips to facilities employing biotechnological processes.
Assessment: Performance in tests, tutorials, assignments & presentations (40%); 3 h exam (60%).
DP Requirement: mark of 40%, attendance at 80% of lectures and tutorials, and 100% attendance of field trips.

Environmental Biotechnology
MICR723 P2   (0L-36T-0P-2S-84H-20R-0F-15G-3A-13W-16C)

Aim: To introduce advanced aspects of environmental biotechnology. To expose students to the application of microbial processes in addressing environmental issues such as pollution, waste-treatment and energy generation.

Content: Selected topics highlighting current advances, analytical techniques and applications in the field of environmental biotechnology. These may change from year to year. Examples include: type sources of pollutants; microbial responses to anthropogenic stress; anaerobic digestion; biofuels; biosorption; biofiltration; bioleaching; bioremediation (*in situ* and *ex situ*); composting; phytoremediation; solid waste treatment; and, wastewater treatment.

Assessment: Assignments and presentations (40%); 1 h oral exam (60%).

DP Requirement: Class mark of 40%, attendance at 80% of tutorials.

Advanced Environmental Microbiology

MICR724 P2   (0L-36T-0P-2S-84H-20R-0F-15G-3A-13W-16C)

Aim: To introduce advanced aspects of environmental microbiology and microbial ecology.

Content: Selected topics highlighting current advances and the latest developments in environmental microbiology and microbial ecology. These may change from year to year. Examples include: phylogenetically based methods in microbial ecology, biodiversity mining and metagenomics, biogeochemical cycling and microbial role in biodeterioration and biodegradation processes, microbial biocatalysis, microbial biofilms, microbial interactions with plants, animals and other microbes.

Assessment: Assignments and presentations (40%); 3 h exam (60%).

DP Requirement: Class mark of 40%, attendance at 80% of tutorials.

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Pathophysiology

Offered in the School of Agricultural, Earth and Environmental Sciences

Introduction to Pathophysiology

MPHY210 P1   (39L-0T-20P-0S-62H-19R-0F-10G-10A-15W-16C)

Prerequisite Modules: BIOL101; CHEM110; CHEM120; HPHY210

Aim: To give the student an overview of the physiological processes or mechanisms whereby disease conditions develop and progress.

Content: Contents include the fundamental mechanisms of health and disease; morphology, physiology and classifications of microorganisms and viruses; effective and ineffective health protection; integrated control and dysfunction; nutrition; and elimination function and dysfunction.

Practicals: A visit to the pathology museum, UKZN Medical School. One major case-study.

Assessment: Practical evaluation (17%), 2 tests (16%), 3 h exam (67%).

DP Requirement: 40% Class mark, 80% attendance at practicals.

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Nutrition

Offered in the School of Agricultural, Earth and Environmental Sciences

Introductory Nutrition & Community Resources

NUTR114 P1   (39L-10T-18P-0S-62H-25R-0F-0G-6A-13W-16C)

Aim: To enable students to develop an understanding of: the link between health and nutrition, various factors affecting eating behaviour, what causes malnutrition, the guidelines for healthy eating, and food purchasing & food safety issues. **Content:** Introduction to nutrition; nutrients (overview); factors affecting eating behaviour; public health nutrition; planning a healthy diet; procuring and using food.

Practicals: Practicals are based on module content (one practical on each topic)...

Assessment: Assignment/practical and test for each section of the module (33%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at practicals.
Subminimum to pass: 40% in (exam/assessment)

Human Nutrition 1: Lifecycle & Macronutrients
NUTR124 P2   (39L-10T-24P-0S-62H-20R-0F-0G-5A-13W-16C)
Prerequisite Requirement: At least 40% in BIOL101, CHEM110 and NUTR114.
Corequisite: CHEM120.
Aim: To give an understanding of nutrition in the lifecycle, energy and macronutrients and the roles of Dieticians & Nutritionists.
Content: Energy; protein; carbohydrate; fibre; fats; alcohol; pregnancy & lactation; nutrition during infancy, childhood, adolescence & aging; skills, capabilities & job opportunities for the Dietician and Nutritionist.
Practicals: Food composition tables. Food quantities manuals. Exchanges. Case study.
Assessment: 2 tests (20%), prac/assignments (13%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at practicals.
Subminimum to pass: 40% in (exam/assessment)

Micronutrients, Nutritional Assessment, SA
NUTR224 P1   (39L-10T-33P-0S-53H-20R-0F-0G-5A-13W-16C)
Prerequisite Modules: NUTR114, NUTR124.
Corequisite: BIOC201, MPHY210.
Aim: To provide an understanding of micronutrients, assessment of nutritional status, the nutrition situation in South Africa and a brief introduction to research.
Content: Fat & water soluble vitamins. Water. Minerals. Nutritional assessment. Nutrition status of South Africans, with introduction to concepts & importance of research. Case studies.
Practicals: Introduction to academic writing, critical evaluation of micronutrient supplement, case studies, assessment of micronutrient intake, seminar writing, oral presentations, taking anthropometric measurements.
Assessment: 2 tests (20%), pracs/assignments (13%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at practicals.
Subminimum to pass: 40% in (exam/assessment)

Research and Nutritional Epidemiology
NUTR312 P2   (47L-0T-30P-0S-53H-5R-0F-10G-15A-15W-16C)
Prerequisite Modules: NUTR224.
Aim: The main aim of this module is to give Dietetic students an in-depth understanding of the research processes used in nutrition and dietetic-related research and provide them with the necessary skills to evaluate the literature and write a literature review. In addition, the aim is to cultivate an in-depth practical approach to how nutrition research makes an impact on malnutrition, HIV/AIDS and Tuberculosis.
Content: The research process, reviewing the literature, types of studies, research ethics, validity, precision, bias, sampling, methodology to determine dietary intake, qualitative versus quantitative techniques, planning and writing analytical seminars. The role of research in estimating prevalence, diagnosis, dietary management and local public health nutrition intervention policies for the management of severe malnutrition, HIV/AIDS and Tuberculosis.
Practicals: The practicals include critiquing existing research in terms of study design, sampling, reliability and validity of the methods employed for data collection purposes as well as the appropriateness of conclusions drawn as well as anthropometry, interpretation of z-scores as per the Road to Health Booklet and theoretical case studies. The student also needs to complete a research proposal which forms the basis for the Research Project in Dietetics (DIET741).
Assessment: Practical evaluation and assignments (25%), 1 test (10%), proposal (15%); 3 h exam (50%).
DP Requirement: 40% Class mark, 80% attendance at practicals.

Nutrition & Communication
NUTR342 P2   (39L-0T-39P-0S-62H-15R-0F-0G-5A-13W-16C)

Prerequisite Modules: NUTR224.
Aim: To equip students to plan, conduct and evaluate effective nutrition education programmes.
Content: What are nutrition and nutrition education? Why educate in food and nutrition? Learning and influences on the learning process. Defining needs. Setting goals and objectives. Defining the destination. The communicator/educator? Selecting the code and formats. Using teaching aids. Programme evaluation. Communication problems. Adult education.
Practicals: Visual and hands-on participation in exercises and preparation for a nutrition education episode.
Assessment: Assignments (23%), tests (10%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at practicals.
Subminimum to pass: 40% in (exam/assessment)

Community Nutrition Level3
NUTR343 P1   (39L-0T-39P-0S-53H-20R-5F-0G-4A-13W-16C)
Prerequisite Modules: NUTR224.
Aim: To gain an understanding of nutrition security in South Africa & internationally, and initiatives to improve nutrition security.
Content: World & SA nutrition situation; Epidemiological concepts, methods & applications to nutrition; Policies & programmes to improve nutrition; Making policy; Nutrition & Human Rights; Advocacy; The INP; Assessment of communities; Principles of successful nutrition programmes; Health services in SA; Child survival programmes; Social grants. Food legislation and labelling.
Practicals: Causes of malnutrition in SA; KZN profile; nutrition strategy for SA; community assessment; community project visit; human rights; nutrition advocacy; Local NGOs; infant feeding (HIV).
Assessment: Assignments (6%), Practicals (5%), Tests (22%); 3 h exam (67%).
DP Requirement: 40% Class mark, 80% attendance at practicals.
Subminimum to pass: 40% in (exam/assessment)

Community Nutrition Internship in Dietetics
NUTR410 PY   (48L-0T-26P-7S-57H-20R-153F-0G-4A-15W-32C)
Prerequisite Requirement: Students must have passed all Level III and lower modules within the Bachelor of Science in Dietetics and Human Nutrition Programme.
Aim: To provide practical experience of community nutrition interventions.
Content: Revision. Growth monitoring and promotion. Lactation management, nutrition, HIV/AIDS and TB. Daily reports. Group activity, making educational material. Selected area of interest in Community Nutrition for individual report and book review.
Practicals: C Students work in antenatal clinics, postnatal/ maternity wards, well baby clinic, paediatric outpatients, medical outpatients and HIV clinics.
Assessment: MCQs, evaluation of practical and written tasks, reports, oral examination, written examination. Minimum of 75% for MC questionnaire prior to practice placement (0%). Professional evaluation and task assessment (14%, subminimum of 50%), written reports (15%), literature review (2%), oral exam (2%); 3h exam (67%, subminimum 40%).
DP Requirement: 40% Class mark

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Physics

Offered in the School of Chemistry and Physics

Comp Mechanics & Symbolic Programming

CPHY212 P2 (36L-9T-36P-0S-57H-16R-0F-0G-6A-15W-16C)

Prerequisite Requirement: PHYS211, PHYS263

Corequisite: None.

Aim: To continue introducing general computational techniques and to model and behaviours of mechanical systems using computational techniques.

Content: The two-body problem, orbits in an inverse square force field, planetary motion, projectiles with friction. Variable mass systems, coupled oscillations, damped driven simple harmonic motion, nonlinear pendulums. Further introduction to Symbolic manipulation using Mathematica: performing algebraic and calculus manipulations, solving equations, graph plotting, application to physical problems.

Assessment: Projects (60%), tests (40%).

DP Requirement: This is a continuous assessment module, so that there are no DP requirements: NB this module has no exam or supplementary exam.

Mechanics, Optics and Thermal Physics

PHYS110 P1 (36L-9T-36P-0S-57H-16R-0F-0G-6A-13W-16C)

Corequisite: MATH130 or 195.

Aim: To introduce mechanics, geometrical optics, and thermal physics.

Content: Mechanics: fundamental units, vectors, scalars, kinematics, particle dynamics, gravitation, work, energy, momentum, equilibrium of rigid bodies, rotational motion, angular momentum, hydrostatics, elastic properties of materials, simple harmonic motion. Waves: transverse, longitudinal, travelling, standing, beats, Doppler effect. Thermal Physics: temperature, heat, calorimetry, thermal expansion, conduction, radiation, ideal gases, thermodynamics.

Assessment: Tests (24%), practicals (6%); 3 h exam (70%).

DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.
Credit may not be obtained for both PHYS110 and PHYS195.

Mechanics

PHYS113 W1 (36L-9T-36P-0S-57H-16R-0F-0G-6A-15W-16C)

Prerequisite Requirement: None.

Corequisite: MATH130 or 195.

Aim: To introduce mechanics (including waves).

Content: Units, physical quantities and vectors; motion along a straight line; motion in two or three dimensions; Newton's laws of motion; applications of Newton's laws of motion; work in kinetic energy; potential energy and energy conservation; momentum; impulse and collisions; rotation of rigid bodies; dynamics of rotational motion; equilibrium and elasticity; fluid mechanics; gravitation; period motion; mechanical waves; sound and hearing.

Assessment: Tests (20%), practicals (10%); 3 h exam (70%).

DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.
Credit may not be obtained for PHYS113 and PHYS110 or PHYS195.

Thermodynamics and Electromagnetism

PHYS114 W2 (36L-9T-36P-0S-57H-16R-0F-0G-6A-15W-16C)

Prerequisite Requirement: 40% in PHYS113 or 60% in PHYS131.

Corequisite: MATH140 or 196.

Aim: To introduce thermodynamics and electromagnetism.

Content: Thermodynamics: temperature and heat; thermal properties of matter; the first law of thermodynamics; the second law of thermodynamics. Electromagnetism: electric charge and electric field; Gauss's law; electric potential;

capacitance and dielectrics; current, resistance, and electromotive force; direct-current circuits; magnetic fields and magnetic forces; sources of magnetic field; electromagnetic induction; alternating current; electromagnetic waves.
Assessment: Tests (20%), practicals (10%); 3 h exam (70%).
DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.
Credit may not be obtained for PHYS114 and PHYS120 or PHYS196.

Electromagnetism, Waves and Modern Physics
PHYS120 P2   (36L-9T-36P-0S-57H-16R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 40% in PHYS110 or 60% in PHYS131.
Corequisite: MATH140 or 196.
Aim: To introduce electromagnetism, waves, physical optics and modern physics.
Content: Electricity and Magnetism: charge, Coulomb's law, electric field, Gauss' law, electric potential, capacitance, resistance, Ohm's law, DC circuits, Kirchhoff's rules, ammeters, voltmeters, Ampère's law, Faraday's law, inductance. Geometrical Optics: reflection, refraction, thin lenses, mirrors, prisms, optical instruments. Physical Optics: interference, diffraction, polarisation. Modern physics: photoelectric effect, Bohr model of hydrogen atom, nucleus, radiation.
Assessment: Tests (24%), practicals (6%); 3 h exam (70%).
DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.
Credit may not be obtained for both PHYS120 or PHYS114 and PHYS196.

Intro Physics for Life Sciences & Agriculture
PHYS131 P1 W1   (36L-9T-36P-0S-57H-16R-0F-0G-6A-13W-16C)
Aim: To introduce basic concepts in mechanics, geometrical optics, and thermal physics.
Content: Mechanics: fundamental units, vectors, scalars, kinematics, particle dynamics, gravitation, work, energy, momentum, simple harmonic motion, equilibrium of rigid bodies, wave fundamentals, rotational motion, angular momentum, hydrostatics, elastic properties of materials, surface tension. Geometrical Optics: reflection, refraction, thin lenses, mirrors, prisms, optical instruments, the eye. Thermal Physics: temperature, heat, calorimetry, thermal expansion, conduction, radiation, ideal gases, thermodynamics.
Assessment: Tests (24%), practicals (6%); 3 h exam (70%).
DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.
Note: For the purposes of serving as prerequisite for other modules, a result of 60% or more will be regarded as equivalent to PHYS110 or PHYS113.

Electromagnetism & Modern Phys for Life Sc
PHYS132 W2   (36L-9T-36P-0S-57H-16R-0F-0G-6A-13W-16C)
Prerequisite Requirement: 40% in PHYS131 or PHYS110.
Aim: To introduce the basic concepts of electricity, magnetism, physical optics and modern physics.
Content: Electricity and Magnetism: electric charge, Coulomb's law, electric field, electric potential, capacitance, resistance, Ohm's law, DC circuits, Kirchhoff's rules, ammeters, voltmeters, magnetic field, magnetic force, Faraday's law, Lenz's law, inductance. Waves: transverse, longitudinal, travelling, standing, beats, Doppler effect. Physical Optics: interference, diffraction, polarisation. Modern physics: photoelectric effect, Bohr model of hydrogen atom, nucleus, radiation.
Assessment: Tests (24%), practicals (6%); 3 h exam (70%).
DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.
Note: For the purposes of serving as prerequisite for other modules, a result of 60% or more will be regarded as equivalent to PHYS120.

Modern Physics for Life Sciences & Agric
PHYS133 P2   (18L-6T-18P-0S-27H-8R-0F-0G-3A-13W-8C)
Prerequisite Requirement: 40% in PHYS131 or PHYS110 or PHYS113.

Aim: To provide an introduction to Modern Physics, presented in an applied and practical manner with an emphasis on problem solving.

Content: Electricity and Magnetism: Charge, Coulomb's law, electric field, electric potential. Current, emf, DC circuits. Magnetic fields and forces, AC waveforms and devices. Physical Optics: Interference and diffraction of light, polarisation. Modern physics: The nucleus, nuclear reaction equations, isotopes. Radioactivity, decay law and Half-lives. Biological effects of radiation, handling of radioactive sources.

Assessment: Tests (24%), practicals (6%); 2 h exam (70%).

DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.

Engineering Physics 1A

PHYS151 H1   (36L-9T-36P-0S-57H-16R-0F-0G-6A-13W-16C)

Aim: Introduction to, and an ability to apply, mechanics, oscillations and thermal physics at an introductory level. This is a calculus-based module.

Content: Mechanics: Units, physical quantities and vectors, motion along a straight line, motion in two or three dimensions, Newton's laws of motion, application of Newton's laws, work and kinetic energy, momentum, impulse and collisions, rotation of rigid bodies, dynamics of rotational motion, equilibrium and elasticity, gravitation, hydrostatics. Oscillations and Waves: Periodic motion, mechanical waves, wave interference and normal modes, sound. Thermal physics: Temperature and heat, thermal properties of matter.

Assessment: Tests (24%), practicals (6%); 3 h exam (70%).

DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals. **For Engineering students only.**

Engineering Physics 1B

PHYS152 H2   (36L-9T-36P-0S-57H-16R-0F-0G-6A-13W-16C)

Prerequisite Requirement: 40% in PHYS151.

Aim: To gain understanding of, & ability to apply, thermodynamics, electricity & magnetism, geometrical optics & atomic physics at an introductory level. This is a calculus-based module.

Content: Thermal Physics: 1st & 2nd laws of thermodynamics. Electricity & magnetism: Electric charge & field, Gauss's law, electric potential, capacitance & dielectrics, current, resistance & electromotive force, direct-current circuits, magnetic field & magnetic forces, sources of magnetic field, electromagnetic induction, inductance & alternating current. Optics: The nature & propagation of light, geometric optics & optical instruments. Atomic Physics: Photons, electrons & atoms, atomic structure.

Assessment: Tests (24%), practicals (6%); 3 h exam (70%).

DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals. **For Engineering students only.**

Chemical Engineering Physics 1A

PHYS161 H1 P1   (18L-6T-18P-0S-27H-8R-0F-0G-3A-13W-8C)

Aim: To gain understanding of, and ability to apply, mechanics at an introductory level. This is a calculus-based module. **Content:** Mechanics: Units, physical quantities and vectors, motion along a straight line, motion ion two or three dimensions, Newton's laws of motion, application of Newton's laws, work and kinetic energy, momentum impulse and collisions, rotation of rigid bodies, dynamics of rotational motion, equilibrium, gravitation, fluid statics.

Assessment: Tests (24%), practicals (6%); 2 h exam (70%).

DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals. **For Engineering students only.**

Chemical Engineering Physics 1B

PHYS162 H2 P2   (36L-9T-36P-0S-57H-16R-0F-0G-6A-13W-16C)

Prerequisite Requirement: 40% in PHYS161.

Aim: To gain understanding of & ability to apply oscillations & waves, electricity & magnetism, & atomic & nuclear physics at an introductory level. A calculus-based module.

Content: Oscillations & Waves: Periodic motion, mechanical waves, interference & normal modes, sound, nature & propagation of light. Electricity & magnetism: Electric charge & electric field, Gauss's law, electric potential, capacitance & dielectrics, current, resistance & electromotive force, direct-current circuits, magnetic field & forces, sources of magnetic field, electromagnetic induction, inductance & alternating current. Atomic & Nuclear Physics: Photons, electrons & atoms, atomic structure, nuclear physics.
Assessment: Tests (24%), practicals (6%); 3 h exam (70%).
DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.
For Engineering students only.

Mech Optics & Thermal Physics (Augmented)
PHYS195 PY WY   78L-36T-36P-0S-93H-60R-0F-0G-27A-26W-16FC-16DC)
Corequisite: MATH195.
Aim: To introduce mechanics, geometrical optics, and thermal physics.
Content: This module is only for students in the BSc4(Augmented). It covers the syllabus of PHYS110 but, in addition, includes a substantial amount of supplementary material and tuition designed for students who are under-prepared for university-level studies to a maximum of 160 Hours.
Assessment: Tests/Assignments/Homework and quizzes (30%), practical reports (20%); 3 hr theory exam (50%).
DP Requirement: Class mark of 40%, Attendance at 80% of lectures, tutorials and practicals and 100% attendance at all assessments.
Credit may not be obtained for both PHYS195 and PHYS110/113. This module is worth 16 degree credits and 16 foundational credits.

Electromagnetic Waves & Mod Phys (Augmented)
PHYS196 PY WY   (78L-36T-36P-0S-93H-60R-0F-0G-27A-26W-16FC-16DC)
Prerequisite Requirement: 40% in PHYS195; 40% in (MATH130 or MATH195).
Corequisite: MATH196.
Aim: To introduce electromagnetism, waves, physical optics and modern physics.
Content: This module is available only to students registered for BSc4(Augmented). It covers the syllabus of PHYS120 but, in addition, includes a substantial amount of supplementary material and tuition designed for students who are under-prepared for university-level studies to a maximum of 160 hours.
Assessment: Test/Assignment/homework and quizzes (30%), practical reports (20%); 3hr theory exam (50%).
DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.
Credit may not be obtained for both PHYS196 and PHYS120/114. This module is only for students in the BSc4 (Augmented) programme. This module is worth 16 degree credits and 16 foundational credits.

Mechanics & Modern Physics
PHYS211 P1   (36L-9T-36P-0S-57H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: PHYS110, 120; MATH130 or 195; MATH 140 or 196.
Aim: To introduce students to mechanics and modern physics at an intermediate level.
Content: Solution of dynamical problems. Energy, momentum, angular momentum of a system of particles. Harmonic oscillator. Special relativity. Black body radiation. Photoelectric effect. Bohr model. Compton effect. De Broglie hypothesis.
Assessment: Practicals (20%), tests (15%); 3 h exam (65%).
DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.

Electromagnetism, Waves & Vibrations
PHYS212 P2   (36L-9T-36P-0S-57H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: PHYS110, 120; MATH130 or 195; MATH 140 or 196.
Aim: To introduce students to electromagnetism, waves and vibrations at an intermediate level.
Content: Electromagnetism, including Maxwell's equations in integral form. DC and AC circuit theory. Wave theory and waves in physical media. Waves, driven vibrations and coupled oscillators. Thermal Physics: macroscopic vs.

microscopic physics, zeroth, 1st, 2nd and 3rd laws, reversible and irreversible processes, thermodynamic cycles, entropy, thermodynamic potentials and relations.
Assessment: Practicals (20%), tests (15%); 3 h exam (65%).
DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.

Optics and Modern Physics
PHYS213 W1   (36L-12T-36P-0S-40H-30R-0F-0G-6A-13W-16C)
Prerequisite Modules: PHYS113 (or PHYS110), 114 (or PHYS120); MATH130 or 195; MATH140 or 196.
Corequisite: MATH212.
Aim: The main aim of the module is to introduce optics and modern physics.
Content: The nature and propagation of light; geometric optics; interference; diffraction; relativity; photons: light waves behaving as particles; particles behaving as waves; wave functions; atomic structure; molecules and condensed matter; nuclear physics; particle physics and cosmology.
Assessment: Class mark (30%), 3 h theory exam (70%).
DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.

Classical mechanics
PHYS214 W2   (36L-9T-36P-0S-57H-16R-0F-0G-6A-15W-16C)
Prerequisite Modules: PHYS113 or PHYS110, PHYS114 or PHYS120; MATH130 or 195; MATH140 or 196.
Corequisite: Not applicable
Aim: The main aim of the module is to introduce classical mechanics.
Content: Newtonian mechanics; Lagrangian and Hamiltonian methods; multi-particle systems; the rigid bodies; motion in non-inertial reference frames; linear oscillations.
Assessment: Practicals (20%), tests (15%), 3 h exam (65%).
DP Requirement: Class mark (35%) comprises Tests (15%) and Practicals (20%).

Theoretical & Computational Physics Methods
PHYS231 W1   (36L-9T-36P-0S-57H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: PHYS110/113, 120/114; MATH130 or 195; MATH 140 or 196.
Corequisite: MATH212, PHYS201.
Aim: To introduce students to concepts in the physics of fluids and fields, and use these to develop key theoretical and computational skills needed for senior physics modules.
Content: Mathematical preliminaries. Elements of fluid dynamics and classical theory of fields. Computational modelling of fluids and fields.
Assessment: Practicals (20%), tests (15%); 3 h exam (65%).
DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.

Introductory Applied Physics
PHYS242 W2   (36L-9T-36P-0S-57H-16R-0F-0G-6A-15W-16C)
Prerequisite Modules: MATH130, 140; PHYS110/113, 120/114.
Corequisite: None.
Aim: To introduce applied physics.
Content: Foundations of electronics, open-source computing hardware, fundamentals of photonics.
Assessment: Class mark (35%); 3 h exam (65%).
DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals.**.**

Optics & Wave Motion
PHYS251 H1   (20L-3T-12P-0S-26H-16R-0F-0G-3A-13W-8C)
Prerequisite Requirement: 40% in PHYS152.
Prerequisite Modules: PHYS151.

Aim: To impart knowledge and understanding of, and an ability to apply, optics and wave motion at an intermediate level.

Content: Wave Equation, radiation, geometric optics, interaction of light and matter, polarisation, interference, diffraction, topics from contemporary optics.

Assessment: Class mark (25%); 2 h exam (75%).

DP Requirement: Class mark 40%, 100% attendance at tests, 80% attendance at lectures, tutorials and practicals. **For Engineering students only.**

Computational Physics Methods

PHYS263 P1   (36L-9T-36P-0S-57H-16R-0F-0G-6A-13W-16C)

Prerequisite Modules: PHYS110, 120; MATH130 or 195; MATH 140 or 196.

Aim: To introduce programming in Fortran90 and symbolic manipulation packages (e.g. Mathematica), and develop computational methods needed for senior physics modules.

Content: Introduction to Fortran90: language elements, specifications, expressions, control statements, arrays, procedures, inputs-outputs. Introduction to symbolic manipulation packages (e.g. Mathematica): creating & manipulating expressions, performing algebraic & calculus manipulations, solving equations, graph plotting. Introduction to numerical methods: numerical integration, differentiation, least-squares fits, roots of equations, solutions of simultaneous equations. Application in extensive project work dealing with physical problems.

Assessment: Continuous: projects (60%), tests (40%).

DP Requirement: Not applicable.

This module has no supplementary exam.

Quantum Physics

PHYS313 W1   (27L-9T-36P-0S-66H-16R-0F-0G-6A-15W-16C)

Prerequisite Modules: (MATH212 and MATH251) or PHYS263; (PHYS201 or PHYS211) and (PHYS204 or PHYS214 or PHYS212)

Aim: The main aim of the module is to introduce students to the foundations of quantum physics.

Content: The formalism of quantum mechanics, quantum mechanics in three dimensions, identical particles, symmetries and conservation laws, perturbation theory and approximations, scattering, quantum dynamics, entanglement.

Assessment: Class mark (35%); 3 h exam (65%). Class mark comprises Tests (15%) and Practicals (20%).

DP Requirement: Class mark 40%, 100% attendance at tests, completion of practicals, 80% attendance at lectures, tutorials.

Statistical Physics

PHYS314 W2   (27L-9T-36P-0S-66H-16R-0F-0G-6A-15W-16C)

Prerequisite Modules: (MATH212 and MATH251) or PHYS263; (PHYS201 or PHYS213) and (PHYS204 or PHYS214).

Aim: The main aim of the module is to introduce students to the foundations of statistical physics.

Content: Thermodynamics, kinetic theory, classical statistical mechanics, quantum statistical mechanics, phase transitions, Monte Carlo methods, selected applications.

Assessment: Class mark (35%); 3 h exam (65%). Class mark comprises Tests (15%) and Practicals (20%).

DP Requirement: Class mark 40%, 100% attendance at tests, completion of practicals, 80% attendance at lectures, tutorials.

Condenced Matter Physics and Nuclear and Particle Physics

PHYS315 W2   (27L-9T-36P-0S-66H-16R-0F-0G-6A-15W-16C)

Prerequisite Modules: MATH212, 251, (PHYS201 or PHYS213) and (PHYS204 or PHYS214).

Aim: The main aim of the module is to introduce students to condensed matter physics and to nuclear and particle physics.

Content: Condensed matter physics: mechanical properties of matter; interatomic forces and bonding in solids; phonons and heat capacity; crystal structure and Bragg scattering; von Laue and X-ray diffraction; electron theory of

solids; semiconductors and doping; magnetic properties of matter. Nuclear and Particle Physics: nuclear masses and binding energies; models of the nucleus; radioactive decay, fission and fusion; nucleon substructure; fundamental forces and the standard model.

Assessment: Class mark (35%); 3 h exam (65%). Class mark comprises Tests (15%) and Practicals (20%).

DP Requirement: Class mark 40%, 100% attendance at tests, completion of practicals, 80% attendance at lectures and tutorials.

Instrumentation and Signal Processing

PHYS343 W1   (27L-9T-36P-0S-66H-16R-0F-0G-6A-15W-16C)

Prerequisite Modules: PHYS234, 242.

Aim: To introduce students to techniques of instrumentation, data processing, and measurement.

Content: Instrumentation electronics; signal processing; machine learning; computational intelligence, measurement sensors and measurement techniques.

Assessment: Practicals (20%), tests (15%); 3 h theory exam (65%).

DP Requirement: Class mark 40%, 100% attendance at tests, completion of all practicals, 80% attendance at lectures and tutorials.

Topics in Applied Physics

PHYS345 W2   (27L-9T-36P-0S-66H-16R-0F-0G-6A-15W-16C)

Prerequisite Modules: (MATH212 and MATH251) or PHYS263; (PHYS201 or PHYS213) and (PHYS204 or PHYS214).

Aim: To introduce selected topics of applied physics.

Content: Topics include, but are not confined to: renewable energy; photonics; remote sensing in space and atmospheric science.

Assessment: Practicals (20%), tests (15%); 3 h theory exam (65%).

DP Requirement: Class mark 40%, 100% attendance at tests, completion of all practicals, 80% attendance at lectures and tutorials.

Classical Mechanics and Quantum Physics

PHYS361 P1   (27L-9T-36P-0S-66H-16R-0F-0G-6A-13W-16C)

Prerequisite Modules: (MATH212 and MATH251) or PHYS263; (PHYS201 or PHYS211) and (PHYS204 or PHYS214 or PHYS212)

Aim: To provide a foundation in classical mechanics and quantum physics.

Content: Classical Mechanics: introductory Lagrangian and Hamiltonian mechanics. Quantum Physics: wave functions, Schrödinger's equation, observables and operators, hermiticity, commutation relations, uncertainty. Hydrogen and many-electron atoms, central field approximation, configurations.

Assessment: Practicals (20%), tests (15%); 3 h theory exam (65%).

DP Requirement: Class mark 40%, 100% attendance at tests, completion of all practicals, 80% attendance at lectures and tutorials.

Statistical Physics and Condensed Matter

PHYS362 W2   (27L-9T-36P-0S-66H-16R-0F-0G-6A-13W-16C)

Prerequisite Modules: (MATH212 and MATH251) or PHYS263; (PHYS201 or PHYS213) and (PHYS204 or PHYS214)

Aim: To provide a foundation in statistical physics and condensed matter.

Content: Content: Statistical Physics: accessible states, entropy, ensembles, partition functions, Maxwell, Fermi-Dirac and Bose-Einstein distributions, Doppler broadening, quantum statistics, black-body radiation. Condensed Matter: bonding in solids; Bravais lattices, unit cells, lattice directions, Miller indices; the reciprocal lattice, Brillouin zones; lattice vibrations, phonons, Einstein & Debye models, lattice specific heat acoustic & optic modes; Bragg, Von Laue & X-ray diffraction; free electron Fermi gas, energy bands.

Assessment: Practicals (20%), tests (15%); 3 h theory exam (65%).

DP Requirement: Class mark 40%, 100% attendance at tests, completion of all practicals, 80% attendance at lectures and tutorials.

Electrodynamics
PHYS363 W1   (27L-9T-36P-0S-66H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: MATH212, 251, (PHYS201 or PHYS213) and (PHYS204 or PHYS214).
Aim: To provide a foundation in electrodynamics, electromagnetic waves, and classical optics.
Content: Electromagnetic Theory - Electric fields and magnetic fields in matter; Electrodynamics - Ohm's Law, Faraday's Law, displacement current, Maxwell's equations, continuity equation, Poynting's theorem; Electromagnetic waves – waves in vacuum, reflection and transmission, plane, polarisation, waves in matter, dispersion; Classical Optics - polarisers, interferometers, Fraunhofer and Fresnel diffraction, coherence.
Assessment: Practicals (20%), tests (15%); 3 h theory exam (65%).
DP Requirement: Class mark 40%, 100% attendance at tests, completion of all practicals, 80% attendance at lectures and tutorials.

Atomic, Nuclear and Particle Physics
PHYS364 W2   (27L-9T-36P-0S-66H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: MATH212, 251, (PHYS201 or PHYS213) and (PHYS204 or PHYS214).
Aim: To introduce concepts in atomic physics, quantum optics, nuclear physics and particle physics.
Content: Atomic Physics: Time-independent perturbation theory, Zeeman and Stark effects, He-atom and manyelectron atoms, parity and selection rules. Introduction to quantum optics: the photon, emission and absorption of photons by atoms, the laser. Nuclear Physics: nuclear properties, shell model, liquid drop model, semi-empirical mass formula, alpha, beta and gamma radiation, fission, fusion; Introductory Particle Physics Nucleon sub-structure, and elementary particles.
Assessment: Practicals (20%), tests (15%); 3 h theory exam (65%).
DP Requirement: Class mark 40%, 100% attendance at tests, completion of all practicals, 80% attendance at lectures and tutorials.

Electromagnetic Theory and Classical Optics
PHYS365 P1   (27L-9T-36P-0S-66H-16R-0F-0G-6A-13W-16C)
Prerequisite Modules: (MATH212 and MATH251) or PHYS263; (PHYS201 or PHYS211) and (PHYS204 or PHYS214 or PHYS212).
Aim: To provide a foundation in electromagnetic theory and classical optics.
Content: Electromagnetic Theory: Gauss', Stokes' theorems, electric charge, current, continuity equation, Maxwell's equations, conductivity, Poisson's & Laplace's equations, uniqueness theorem, images, multipole expansion, electric dipoles, dielectric materials, vector potential, magnetic dipoles, electromagnetic waves, Poynting's theorem. Classical Optics: polarisation, interference, diffraction, coherence.
Assessment: Practicals (20%), tests (15%); 3 h theory exam (65%).
DP Requirement: Class mark 40%, 100% attendance at tests, completion of all practicals, 80% attendance at lectures and tutorials.

Statistical Physics and Atomic Spectroscopy
PHYS367 P2   (27L-9T-36P-0S-66H-16R-0F-0G-6A-15W-16C)
Prerequisite Modules: (MATH212 and MATH251) or PHYS263; (PHYS201 or PHYS211) and (PHYS204 or PHYS214 or PHYS212).
Aim: To provide the theoretical foundations of statistical physics and atomic spectroscopy.
Content: Statistical Physics: accessible states, entropy, ensembles, partition functions, Maxwell, Fermi-Dirac and Bose- Einstein distributions, Doppler broadening, quantum statistics, black-body radiation. Atomic Spectroscopy: Electronic configurations, Pauli's exclusion principle. Perturbation theory, terms, levels, Hund's rules, energy-level diagrams, selection rules, Zeeman effect; introduction to the laser.
Assessment: Practicals (20%), tests (15%); 3 h theory exam (65%).

DP Requirement: Class mark 40%, 100% attendance at tests, completion of all practicals, 80% attendance at lectures and tutorials.

Condensed Matter and Sub-atomic Physics

PHYS368 P2 (27L-9T-36P-0S-66H-16R-0F-0G-6A-15W-16C)
Prerequisite Modules: MATH212 and MATH251) or PHYS263; (PHYS201 or PHYS211) and (PHYS204 or PHYS214 or PHYS212).
Aim: To provide the theoretical foundations of Condensed Matter Physics, Nuclear Physics and Particle Physics.
Content: Condensed Matter: bonding in solids; Bravais lattices, unit cells, lattice directions, Miller indices; the reciprocal lattice, Brillouin zones; lattice vibrations, phonons, Einstein and Debye Models, lattice specific heat, acoustic and optic modes; Bragg, Von Laue and X-ray diffraction; free electron, Fermi gas, energy bands. Nuclear Physics: nuclear properties, shell model, liquid drop model, semi empirical mass formula, alpha, beta and gamma radiation, fission, fusion; Particle Physics: elementary particles, gauge bosons, gluons.
Assessment: Practicals (20%), tests (15%); 3 h theory exam (65%).
DP Requirement: Class mark 40%, 100% attendance at tests, completion of all practicals, 80% attendance at lectures and tutorials.

Classical Field Theory

PHYS701 WC (27L-0T-0P-9S-88H-30R-0F-0G-6A-13W-16C)
Aim: To study classical field theory.
Content: Mathematical tools; electrodynamics; special relativity; elements of general relativity; introduction to numerical methods for electrodynamics.
Assessment: Class mark (25%); 3 h exam (75%).
DP Requirement: 100% attendance at tests, 80% attendance at lectures.
Offered in either Semester 1 or Semester 2.

Quantum Mechanics

PHYS702 WC (27L-0T-0P-9S-88H-30R-0F-0G-6A-13W-16C)
Aim: To study quantum mechanics.
Content: Foundations of quantum mechanics; quantum phenomena; measurement and evolution; selected applications and quantum technology; numerical methods of quantum mechanics.
Assessment: Class mark (25%); 3 h exam (75%).
DP Requirement: 100% attendance at tests, 80% attendance at lectures.
Offered in either Semester 1 or Semester 2.

Statistical Physics & Classical Mechanics

PHYS703 WC (27L-0T-0P-9S-88H-30R-0F-0G-6A-13W-16C)
Aim: To study statistical physics and classical mechanics.
Content: Statistical Physics. Mathematical tools. General concepts. Ergodic theory. Equilibrium statistical mechanics. Non-equilibrium statistical physics. Open quantum systems. Classical Mechanics. Dynamical systems. Lagrangrian and Hamiltonian mechanics. Symplectic mechanics. Hamilton-Jacobi theory.
Assessment: Class mark (25%); 3 h exam (75%).
DP Requirement: 100% attendance at tests, 80% attendance at lectures.
Offered in either Semester 1 or Semester 2.

Special Topics in Physics I

PHYS721 P1 (36L-0T-0P-0S-77H-41R-0F-0G-6A-13W-16C)
Aim: To introduce the Honours student to a number of specialist topics in Physics to suit the career directions and interests of students. Students may also go outside the Physics discipline to select material with equivalent credit, subject to the approval by the School.

Content: Topics include: Advanced symbolic programming, cosmology, galaxies and galactic structure, group theory, particle physics, molecular spectroscopy, polarization optics, relativity, field theory, and other material subject to available expertise.
Assessment: Class mark (25%); 3 h exam (75%).
DP Requirement: 100% attendance at tests, 80% attendance at lectures.

Advanced Topics in Space Science

PHYS722 W2   (27L-6T-0P-6S-79H-30R-0F-0G-12A-15W-16C)
Aim: To allow students to specialise in their chosen areas of NASSP and in Physics.
Content: Topics include, but are not confined to the following major topics in Space Science: the sun, solar wind, magnetosphere, plasmasphere, ionosphere, space-atmosphere interactions.
Assessment: Class mark (25%); 3 h exam (75%).
DP Requirement: 100% attendance at tests, 80% attendance at lectures, 40% class mark.

Advanced Topics in Plasma Physics

PHYS723 W2   (27L-6T-0P-6S-79H-30R-0F-0G-12A-15W-16C)
Aim: To allow students to specialise in their chosen areas of NASSP and in Physics.
Content: Topics include, but are not confined to the following major topics in Plasma Physics; Plasma paramaters, particle motions, plasmas as fluids, tensor waves in plasma, dispersion relations, cut-offs and resonances and Vlasolv theories.
Assessment: Class mark (25%); 3 h exam (75%).
DP Requirement: 100% attendance at tests, 80% attendance at lectures, 40% class mark.

Techniques in Astrophysics and Space Science

PHYS724 W1   (16L-6T-0P-6S-90H-30R-0F-0G-12A-15W-16C)
Aim: To allow students to specialise in their chosen areas of NASSP and in Physics.
Content: Topics include, but are not confined to: Techniques in Space Science and Astrophysics; Basics of Observational coordinate systems and observables, telescopes and detectors, observations and data collection techniques, remote sensing techniques, data analysis techniques including statistical and software methods, applications to facility instruments including those managed by SANSA, SAAO, Hart, RAO and SKA.
Assessment: Class mark (40%); 2 x 1.5 h exam (60%).
DP Requirement: 100% attendance at tests, 80% attendance at lectures, 40% class mark.

Advanced Topics in Astronomy and Astrophysics

PHYS725 W2   (27L-6T-0P-6S-79H-30R-0F-0G-12A-15W-16C)
Aim: To allow students to specialise in their chosen areas of NASSP and in Physics.
Content: Topics include, but are not confined to the following major topics in Astronomy and Astrophysics: Celestial astronomy, the spectrum of light, telescopes, stellar evolution and spectra, compact objects: white dwarfs, neutron stars, general relativity introduction and black holes, the orbits of stars, spiral and elliptical galaxies, galaxy groups and clusters, the large scale distribution of galaxies and active galactic nuclei.
Assessment: Class mark (25%); 3 h exam (75%).
DP Requirement: 100% attendance at tests, 80% attendance at lectures, 40% class mark.

Physics Project

PHYS735 PY WY   (0L-0T-0P-6S-314H-0R-0F-0G-0A-26W-32C)
Aim: To provide an introduction to research methods in experimental, theoretical, computational or educational physics, and to develop communication skills through preparation of a written report and presentation of a seminar.
Content: Experimental, theoretical, computational or educational physics project. May include placement or fieldwork.
Assessment: Report (80%), seminar (20%).
DP Requirement: Not applicable.
Year-long module. This module has no supplementary exam.

Methods of Mathematical and Computational Physics

PHYS736 W1 (27L-9T-0P-0S-88H-30R-0F-0G-6A-15W-16C)

Aim: To equip students with mathematical tools for theoretical physics, and to give students an introduction to the power of computer simulation by solving problems often encountered in Physics.

Content: Topics include, but are not confined to: Elements of complex analaysis and functionals for the solution of problems in quantum mechanics, field theory and statistical physics; basic numerical methods and programming: computational solution of partial differential equations in Physics. Computational analysis and visualisation of data in Physics.

Assessment: Class mark (40%); 2 x 1.5 h exam (60%).

DP Requirement: 100% attendance at tests, 80% attendance at lectures, 40% class mark.

Advanced Topics in Quantum Physics

PHYS737 W2 (27L-9T-0P-0S-88H-30R-0F-0G-6A-15W-16C)

Aim: To allow students to specialise in their chosen areas of Physics.

Content: Topics include, but are not confined to: Quantum Optics, Information Processing and Communication, Open Quantum Systems and Quantum Field Theory.

Assessment: Class mark (25%); 2 x 1.5 h exam (75%).

DP Requirement: 100% attendance at tests, 80% attendance at lectures, 40% class mark.

Advanced Topics in Condensed Matter Physics

PHYS738 W2 (27L-9T-0P-0S-88H-30R-0F-0G-6A-15W-16C)

Aim: To allow students to specialise in their chosen areas of Physics.

Content: Topics include, but are not confined to: Physics of Materials and Physics of the Solid State.

Assessment: Class mark (25%); 2 x 1.5 h exam (75%).

DP Requirement: 100% attendance at tests, 80% attendance at lectures, 40% class mark.

Advanced Topics in Applied Physics

PHYS739 W2 (27L-9T-0P-0S-88H-30R-0F-0G-6A-15W-16C)

Aim: To allow students to specialise in their chosen areas of Physics.

Content: Topics include, but are not confined to: Laser Physics, Photonics, Renewable Energy and Atmospheric Physics.

Assessment: Class mark (25%); 2 x 1.5 h exam (75%).

DP Requirement: 100% attendance at tests, 80% attendance at lectures, 40% class mark.

Statistical Physics

PHYS741 P1 (36L-10T-0P-0S-60H-50R-0F-0G-4A-13W-16C)

Aim: To study the theory and applications of intermediate level statistical physics.

Content: Microcanonical ensemble, canonical ensemble and grand canonical ensemble. Fluctuations, thermodynamic limit. Quantum statistics; the ideal fermion and boson gases, the photon gas.

Assessment: Class mark (25%); 3 h exam (75%).

DP Requirement: 100% attendance at tests, 80% attendance at lectures.

Special Topics in Physics II

PHYS752 P2 (60L-24T-0P-3S-140H-90R-0F-0G-3A-13W-32C)

Aim: To introduce the Honours student to a number of specialist topics in Physics to suit the career directions and interests of students. Students may also go outside the Physics discipline to select material with equivalent credit, subject to the approval of the School.

Content: See PHYS721, Special Topics I for a list of present options, plus Solid State Physics offered in Semester 2.

Assessment: Project work &/or formal exam with a minimum Class mark of 20%.

DP Requirement: 80% attendance.

Quantum Mechanics
PHYS791 P1   (30L-10T-0P-0S-66H-50R-0F-0G-4A-13W-16C)
Aim: To consolidate and extend 3rd-year concepts of quantum mechanics.
Content: Abstract vectors, operations, parity, displacement operators for position and momentum, coordinate representation, time evolution, Hellman-Feynman, virial and hypervirial theorems, shift operators, oscillator angular momentum, H atom, non-degenerate, degenerate, time-dependent perturbation theories.
Assessment: Class mark (25%); 3 h exam (75%).
DP Requirement: 100% attendance at tests, 80% attendance at lectures.

Electrodynamics
PHYS792 P2   (30L-10T-0P-0S-66H-50R-0F-0G-4A-13W-16C)
Aim: To consolidate and extend 3rd-year concepts of electrodynamics.
Content: Review of Maxwell's equations, advanced applications thereof. Electromagnetic potentials and gauge. Relativistic field transformations.
Assessment: Class mark (25%); 3 h exam (75%).
DP Requirement: 100% attendance at tests, 80% attendance at lectures.

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Plant Breeding

Offered in the School of Agricultural, Earth and Environmental Sciences

Plant Breeding Design and Management
PLBR801 P1   (36L-3T-30P-5S-35H-25R-0F-10G-16A-13W-16C)
Prerequisite Modules: STAT222, GENE715, AGPS730.
Aim: To provide postgraduates with skills and competencies to plan and implement plant breeding research, and to plan and design crop breeding research projects. To prepare them for management responsibilities in plant breeding companies.
Content: The selection of plant breeding parents, design of crosses using various mating designs, design of nurseries and trials. Layout of field experiments to evaluate many genotypes under stress and non-stress environments. Critical analysis of operations of a plant breeding programme; measuring adaptation of genotypes to drought, salinity, low soil fertility and pests. Product development.
Practicals: Generating new pedigrees, designing nurseries, trials. Handling and analysis of phenotypic and molecular data. Analysis of data. Visit to plant breeding nurseries and trial fields.
Assessment: Practical Assignments (20%); tests (15%); field report (15%); 3 h exam (50%).
DP Requirement: 40% class mark. Attendance at 80% of practicals and all tests. This
module is only available for non-degree purposes.

Plant Breeding Internship and Seminars
PLBR802 PY   (10L- 0T-20P-20S-150H-30R-26F-20G-44A-26W-16C)
Prerequisite Requirement: Relevant modules in agricultural sciences
Aim: To gain practical experience in the management of breeding populations and essential resources, such as people, and smart processes in commercial and elite public breeding programmes.
Content: Soil, water and pest management; seed technology; classical, participatory, transgenic and molecular breeding; communication, leadership and entrepreneurship; research project.
Practicals: Internship in a plant breeding research environment; short ad hoc field trips on relevant topics.
Assessment: Assignments & tests (25%), presentation & participation in seminars (25%), work practice report (50%).
DP Requirement: Not applicable.
This module has no supplementary exam. This module is only available for non-degree purposes

Topics in Advanced Plant Breeding
PLBR901 PY   (384L-100T-128P-0S-640H-0R-0F-0G-28A-52W-128C)
Aim: Provide ACCI students with understandings and skills relevant to PhD and to senior scientists in plant breeding.
Content: Elements of thesis; fund raising; project planning and proposal writing; budgeting and financial administration; poster and conference paper presentations; applied plant breeding; research methodology; advanced biometry for plant breeders; biotic and abiotic constraints on plant breeding; application of biotechnology to plant breeding.
Practicals: Plant breeding methods and skills.
Assessment: Portfolio of completed tests, essays, practical assignments (50%); project proposal (30%); literature review (20%).
DP Requirement: Not applicable.
Offered over Semester 1 and 2. Only for students in ACCI programme. This module has no supplementary exam.
This module is only available for non-degree purposes.

Plant Pathology

Offered in the School of Agricultural, Earth and Environmental Sciences

Fungi, Food and Phytopathogens
PPTH214 P2   (36L-0T-36P-6S-53H-23R-0F-0G-6A-13W-16C)
Prerequisite Modules: BIOL101 or BIMI120
Aim: To introduce students to a basic understanding of fungi, bacteria, viruses and nematodes causing plant diseases.
Content: An introduction to the structure, function and diversity of plant pathogenic organisms, epidemiology, diseases symptoms and methods of control. Symbiotic relationships, industrial applications and the role of fungi in human health.
Practicals: Hands-on experience in inoculation, germination, infection, isolation and other techniques for identifying fungal plant pathogens.
Assessment: 3 theory tests (8%); practicals (5%); literature survey (5%); seminar presentation (2%); disease collection (10%); 3 h exam (70%).
DP Requirement: Not applicable

Introduction to Viruses
PPTH305 P1   (29L-7T-42P-5S-48H-24R-0F-0G-5A-13W-16C)
Aim: To introduce viruses, the diseases they cause, control of viral diseases and the practical application of viruses.
Content: General characteristics of viruses, viroids, virusoids and prions. Taxonomy, identification, transmission, epidemiology, characterization, control and applications.
Practicals: Laboratory and greenhouse based experiments and one field trip to a virology laboratory.
Assessment: Practical write-ups and one test based on the practical exercises; two class tests based on the lectures; group seminar presentation (33%); 3 h exam (67%).
DP Requirement: Not applicable

Plant Disease Epidemiology & Bacteriology
PPTH330 P1   (40L-10T-40P-18S-24H-23R-0F-0G-5A-13W-16C)
Prerequisite Modules: PPTH214
Aim: To introduce a mathematical background to disease progress, the genetics and biochemistry of disease resistance and an introduction to plant diseases caused by bacteria.
Content: An introduction to quantitative plant disease epidemiology, host-parasite interactions, the genetics of plant disease resistance and plant bacteriology.
Practicals: An applied project involved in the isolation and testing of a biocontrol agent.

Assessment: Tests (17%), bacteriology assignment (8%), prac project & assignments (9%); 3 h exam (66%).
DP Requirement: Not applicable

Principles of Plant Disease Management

PPTH360 P2   (39L-5T-29P-0S-53H-29R-0F-0G-5A-13W-16C)
Prerequisite Modules: PPTH214.
Aim: To present, in detail, plant disease management strategies and tools, against a range of plant diseases.
Content: Introduction to disease management, epidemiological concepts, cultural practices such as crop rotation, debris removal etc. and their role in disease management. Physical control measures, agrochemicals, biological control, genetics of host plant resistance.
Practicals: Laboratory work (isolation of biological control agents and pathogens). Greenhouse based experiments – testing the above in the greenhouse to determine if pathogens cause disease. The effectiveness of biological control agents in controlling the disease.
Assessment: Three tests and practicals (33%); 3 h exam (67%).
DP Requirement: Not applicable

Biotechnology for Plant Pathologists

PPTH370 P2   (39L-12T-39P-5S-36H-24R-0F-0G-5A-13W-16C)
Prerequisite Modules: PPTH305
Aim: To acquaint students with modern biotechnology techniques and how they can be applied to study and solve practical problems in Plant Pathology. To introduce the economic importance of plant viruses, their epidemiology and control.
Content: Molecular markers and their use in plant pathology. DNA recombinant technologies. DNA sequencing. DNA amplification techniques. Plant transformation and genetic engineering for disease resistance. Analysis of transgenic plants. Practical applications of biotechnology in plant pathology. Epidemiology of plant virus diseases. Control of plant virus diseases.
Practicals: Laboratory and greenhouse based experiments and field trips.
Assessment: Two class tests, two practical write-ups, Group seminar presentation (33%); 3 h exam (67%).
DP Requirement: Not applicable

Fungi in Phytopathology - Advanced Mycology

PPTH713 P2   (0L-40T-0P-42S-45H-30R-0F-0G-3A-13W-16C)
Prerequisite Modules: PPTH330, 360 and 370
Aim: To introduce students to advanced, current and controversial topics in phytopathology with emphasis on the impact of fungi on agriculture and food production.
Content: An extensive reading course in advanced topics in plant phytopathology, including: advanced mycology, physiology, biochemistry, aerobiology, conidiogenesis, infection processes and host-parasite interactions, disease forecasting and modelling. A case study of a significant pathogen, the sociological impact of plant diseases. GMO's and food security. Précis and present papers in mini-seminars.
Assessment: Assignments (17%), essays (17%); 3 h theory exam (66%).
DP Requirement: Not applicable

Literature Review and Plant Pathology Research Skills

PPTH715 P2   (39L-10T-0P-20S-53H-5R-0F-0G-33A-15W-16C)
Prerequisite Modules: PPTH330
Co-requisite Modules: PPTH750 or PPTH790
Aim: To develop skills in the accessing and synthesising of scientific literature in plant pathology and acquire the skills to develop research proposals, design, plan and implement plant pathology research, budgeting, presentations and poster skills.

Content: A detailed literature review on a plant pathology topic, using all accessible forms of technical information. Techniques in research proposal writing and budgeting; Field and greenhouse research design, techniques and statistical analysis in plant pathology research.
Assessment: Literature review essay writing (40%), Literature review oral presentation/seminar presentations (20%), research proposal presentations /research report writing (20%), Tests, statistical tutorials and assignments (20%)
DP Requirement: Not applicable

Advanced Topics in Virology

PPTH723 P1 (0L-40T-0P-42S-45H-30R-0F-0G-3A-13W-16C)
Prerequisite Modules: PPTH305, 330, 370.
Aim: To study a wide range of selected topics to fully understand the complex relationships between viruses, their hosts and vectors and to formulate disease control measures.
Content: An extensive reading course in advanced topics in plant phytopathology, and viral epidemiology including: taxonomy of viruses, infection processes, vectored diseases, virus helpers and viroids; significant plant viruses, virus control measures, GE virus resistance and the social impact of viruses; précis and present papers in mini-seminars.
Assessment: Assignments (17%), essays (17%); 3 h exam (66%).
DP Requirement: Not applicable

Advanced Plant Disease Epidemiology

PPTH730 P1 (0L-40T-0P-42S-43H-30R-0F-0G-5A-13W-16C)
Prerequisite Modules: PPTH330, 370.
Aim: To develop advanced concepts and practice in plant disease epidemiology.
Content: Discussion, review and practice of the theory and application of plant disease epidemiology in the form of seminars and laboratory tutorials.
Practicals: An applied project involved in the isolation and testing of a biocontrol agent.
Assessment: Class tests (17%), essays (17%); 3 h exam (66%).
DP Requirement: Not applicable

Field Plant Pathology

PPTH745 P1 (0L-12T-132P-12S-0H-4R-0F-0G-0A-13W-16C)
Aim: Experiential learning of applied plant pathology provided by farm visits to diseased crops.
Content: Weekly visits to farms, nurseries and other sites of plant pathological interest, where applied disease diagnosis and control measures are developed.
Practicals: Field work and evaluations.
Assessment: Field prac reports (100%).
DP Requirement: Not applicable.
This module has no supplementary exam.

Plant Pathology Major Research Project

PPTH750 PY (0L-40T-0P-40S-400H-0R-0F-0G-0A-26W-48C)
Aim: To develop scientific research methods in plant pathology.
Content: An extended research project on a plant pathological topic, to give the student experiential learning of the application of the scientific process in plant pathology.
Practicals: The project will require detailed design, implementation and analysis of a series of experiments for an overall project, at a significant depth.
Assessment: Project report (70%), research paper taken from the report (15%), conference presentation of results (15%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam.

Plant Pathology Research Project
PPTH790 PY   (0L-40T-0P-40S-240H-0R-0F-0G-0A-26W-32C)
Aim: To develop scientific research methods in plant pathology.
Content: A research project on a plant pathological topic, to give the student experiential learning of the application of the scientific process in plant pathology.
Practicals: The project will require detailed design, implementation and analysis of a series of experiments for an overall project.
Assessment: Project report (70%), research paper taken from the report (15%), conference presentation of results (15%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam.

Recombinant DNA Technology
Offered in the School of Life Sciences

Molecular DNA Technology
RDNA202 P2 W2   (39L-10T-39P-0S-60H-7R-0F-0G-5A-13W-16C)
Prerequisite Modules: (BIOL101 or BIMI120); CHEM110, 120.
Aim: To provide a strong foundation in bacterial and viral molecular biology and recombinant DNA technology.
Content: Organisation of bacterial & viral genomes. DNA replication. Regulation of gene expression. Plasmid biology. Transposons and mobile elements. DNA repair & recombination. Theory of cloning, manipulation & analysis of genes and the expression of their protein products. A working knowledge of genetic engineering.
Practicals: Hands on experience in basic recombinant technology techniques: DNA isolation, primer design, restriction enzyme analysis, PCR, cloning, and transformation.
Assessment: Practicals (25%), 2 h theory tests (25%); 3 h exam (50%).
DP Requirement: Class mark of 40%. Attendance at 80% of tutorials and practicals and 100% of tests.
Entry to this module may be restricted to students that are registered for a major or programme in which this module is specifically listed as core or as a core elective.

Resource Management
Offered in the School of Agricultural, Earth and Environmental Sciences

Natural Resource Identification
RMGT151 P1   (39L-0T-32P-0S-40H-20R-0F-24G-5A-13W-16C)
Aim: To provide an introduction into the different natural resources that play a pivotal role in farming systems.
Content: Natural Resource terminology; Bioresource units and bioresource groups; climate; soil erosion; water sources and use; stock watering; soil physical properties; soil water; vegetation dynamics; land units; veld condition assessments.
Practicals: Weekly 2 hour practical.
Assessment: Tests, assignments and practical assessments (60%); 3 h exam (40%).
Subminimum to pass: 40% in exam.
DP Requirement: 40% Class mark; 80% attendance at lectures and practicals.
Only for students registered at Cedara College of Agriculture.

Impact on Natural Resources
RMGT152 P2   (39L-0T-32P-0S-40H-20R-0F-24G-5A-13W-16C)

Aim: To provide insight into the consequences of interventions on the environment and therefore management decisions.

Content: Soil chemical properties; soil fertility; vegetation cover; erosion and its control; gully reclamation; classification and structure of vegetation; vegetation encroachment.

Practicals: Bi-weekly 2 hour practical; scheduled field trip to study natural resource management in a real life setting.

Assessment: Tests, assignments and practical assessments (60%); 3 h exam (40%).

Subminimum to pass: 40% in exam.

DP Requirement: 40% Class mark; 80% attendance at lectures and practicals.

Only for students registered at Cedara College of Agriculture.

Land Preparation

RMGT262 P1   (20L-0T-16P-0S-15H-5R-0F-12G-12A-13W-8C)

Aim: To apply land preparation principles and practices to an agricultural production system.

Content: Soil classification; land capability; land use planning; conservation planning; surveying in the context of land preparation.

Assessment: Tests, assignments and practical assessments (60%); 3 h exam (40%).

Subminimum to pass: 40% in exam.

DP Requirement: 40% class mark; 80% attendance at lectures and practicals.

Only for students registered at Cedara College of Agriculture.

Land Use Planning

RMGT371 PY   (10L-10T-40P-17S-170H-30R-40F-0G-3A-26W-32C)

Prerequisite Modules: FRME262.

Corequisite: FBMT371.

Aim: To enable students to produce, in a real-world setting, a comprehensive farm plan.

Content: Application of land use planning and general agricultural principles.

Practicals: Weekly 2 hour practical.

Assessment: Land use plan, oral and examination (100%). There is no separate class mark. All students are required to produce a land use plan, make an oral presentation and write an examination. Each one of these components has to be passed. Students will receive a single final mark for the module.

DP Requirement: 40% Class mark; 80% attendance at lectures and practicals.

Year-long Module. Only for students registered at Cedara College of Agriculture.

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Rural Resource Management
Offered in the School of Agricultural, Earth and Environmental Sciences

Systems Thinking Foundations

RRMG700 PY   (45L-0T-0P-0S-115H-0R-0F-0G-0A-26W-16C)

Aim: To give students a foundation in experiential learning and systems methodologies.

Content: Formal systems characteristics. Kolb's learning cycle. Hard & soft systems thinking. Soft systems methodology. Viable systems method. Critical systems thinking.

Assessment: 1 report on a project in which a systems methodology is applied to a real world problem situation (100%).

DP Requirement: Not applicable.

Year-long module. This module has no supplementary exam.

Rural Development Placement

RRMG710 PY   (6L-0T-0P-2S-312H-0R-0F-0G-0A-26W-32C)

Aim: To develop and apply a learning framework in the acquisition of a competency based on the theory learned in RRMG712 and/or RRMG722.
Content: Developing and applying a learning framework. Practical application of a learning framework in a real-life experience (internship) in rural development/agricultural extension within a government department, NGO or other relevant agency or organisation. Reflecting on the practical application of the framework and evaluating the framework and the internship experience.
Practicals: An internship with an organisation/institution.
Assessment: Portfolio (80%), oral presentation reflecting on the internship experience (20%). [Portfolio: Placement report (30%), Reflection Report (20%), Programme Proposal (30%)].
DP Requirement: Not applicable.
Year-long module. This module has no supplementary exam.

Project Design & Management
RRMG712 PY   (45L-0T-0P-0S-115H-0R-0F-0G-0A-26W-16C)
Aim: To give students advanced project design & management skills.
Content: Development & development projects. Project cycle: blueprint vs. process approach. Project boundaries & environments: taxonomy of environments & insights from CST. Project Appraisal. Implementation planning: work breakdown structure; Gantt Charts; Critical Path Analysis; PERT. Recent trends in the development paradigm.
Assessment: 1 report on the process & outcome of a project designing activity (100%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam.

Advanced Extension Theory and Practice
RRMG722 PY   (45L-0T-0P-0S-65H-30R-0F-0G-20A-26W-16C)
Aim: To provide students with an in-depth theoretical and practical understanding of agricultural extension.
Content: Theories influencing Agricultural Extension. Broader theories in Development. The theoretical context for Agricultural Extension. The practical context for Agricultural Extension. The outcomes of Agricultural Extension.
Assessment: Written Project Plan addressing Extension Theory, Extension in the context of South Africa and application of theory in a real-world situation (case study) (75%); subject to an oral defence/presentation (25%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam.

Rural Development/Extension Research Project
RRMG730 PY   (20L-0T-60P-3S-397H-0R-0F-0G-0A-26W-48C
Prerequisite Requirement: This module is only for students registered for the BAgric Honours (AERRM)
Aim: To undertake supervised research on a theme relevant to rural development, agricultural development or agricultural extension to develop postgraduate level research and writing skills
Content: Agricultural Extension, Agricultural Development, Rural Development
Assessment: Research Report (80%); Research Journal (20%)
DP Requirement: Not applicable

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Scientific Communication

Communication in Science A
SCOM101 P1 W1   (33L-6T-3P-0S-24H-8R-0F-0G-6A-13W-8C)
Aim: To develop students' confidence and competence in their command of English in a scientific context, namely reading scientific texts, writing scientifically and delivering oral presentations on scientific topics.
Content: The focus is on facilitating students' understanding of the purpose of a range of scientific texts and genres, and assisting them to develop skills in reading, writing and speaking in a scientific context. Attention will be given to areas of competence in English that present challenges for speakers of English as a second language. Through the

process of undertaking short assignments including academic essays, scientific reports and oral presentations, students will be supported in their reading, writing and speaking. There may be a practical component.

Assessment: Tests, Assignments and Oral presentation (50%) and 3 hr Exam (50%).

DP Requirement. Attendance at 80% of lectures and tutorials and 100% of tests. Assignment submissions and oral presentation are compulsory.

Primarily for students in the BSc4 Augmented Stream.

Communication in Science B

SCOM102 P2 W2   (33L-6T-3P-0S-24H-8R-0F-0G-6A-13W-8C)

Aim: To develop students' confidence and competence in their command of English in a scientific context, namely reading scientific texts, writing scientifically and delivering oral presentations on scientific topics.

Content: This module builds on and extends what was covered in SCOM101. The focus remains on facilitating the students' understanding of the purpose of a range of scientific texts and genres, and assisting them to develop skills in reading, writing and speaking in a scientific context. Attention will continue to be given to areas of competence in English that present challenges for speakers of English as a second language. Through the process of undertaking short assignments covering a range of scientific genres such as academic essays, scientific reports and oral presentation, students will continue to be supported in their reading, writing and speaking. There may be a practical component.

Assessment: Tests, Assignments and Oral presentation (50%) and 3 hr Exam (50%).

DP Requirement. Attendance at 80% of lectures and tutorials and 100% of tests. Assignment submissions and oral presentation are compulsory.

Primarily for students in the BSc4 Augmented Stream.

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Soil Science

Offered in the School of Agricultural, Earth and Environmental Sciences

Introduction to Soils & the Environment

SSCI217 P1   (37L-6T-33P-0S-54H-25R-0F-0G-5A-13W-16C)

Prerequisite Modules: CHEM110.

Aim: To understand soil processes and their role within the environment.

Content: Soil-quality; formation; properties; survey; land evaluation. Reactions of nutrients with soil mineral and organic surfaces, land treatment of wastes and soil pollution. Major & trace elements and fertilizer sources. Water retention & movement; water availability; infiltration and evaporation. Soil compaction, aggregate stability and crusting.

Practicals: Field: texture; colour, structure, infiltration; soil identification; land evaluation. Laboratory: particle size; pH; cation exchange properties; P; C; hydraulic conductivity; fertilizer sources; assessment of variability.

Assessment: 2 theory tests (25%), laboratory & field reports & tutorials (25%); 3 h exam (50%).

DP Requirement: Not applicable

Available only to students for whom the module is core.

Pedology

SSCI230 P2   (36L-0T-61P-0S-40H-19R-0F-0G-4A-13W-16C)

Prerequisite Modules: SSCI217.

Aim: To provide an understanding of the field study of soils.

Content: The morphology, genesis and spatial distribution of soils. Palaeopedology and recognition of relic features within current surface soils. Soil classification - South African, FAO, and USDA systems. Soil survey and mapping methods and objectives. Land capability and suitability using international and local systems.

Practicals: The field description and classification of soils. Attendance at two full day field trips held on weekends is compulsory. A compulsory one week field mapping project may also be held and students are required to contribute towards the costs.

Assessment: 2 tests (20%), & project reports (20%); 3 h exam (60%).

DP Requirement: Not applicable

Soil Biology and Biochemistry

SSCI260 P2   (36L-6T-33P-0S-56H-24R-0F-0G-5A-13W-16C)

Prerequisite Modules: SSCI217.

Aim: To provide an understanding of soil organisms, and their role in soil ecosystem functioning.

Content: Diversity of soil organisms (micro, meso and macro fauna) and the synergies among them. Interactions of physical, chemical and biological aspects of the soil environment. Spatial and temporal variation of soil biota. Soil biological effects on fertility and carbon sequestration. Technological applications of soil biology: N Cycle- rhizobium N fixation technology in legumes; nitrification and denitrification in organic waste management; Biochemical transformations of metal elements and implications for pollution; Mycorrhizal symbiosis.

Assessment: Two tests (20%); two laboratory project reports (30%); 3 h exam (50%).

DP Requirement: Not applicable

Soil Fertility & Plant Nutrition

SSCI320 P2   (36L-5T-40P-0S-51H-23R-0F-0G-5A-13W-16C)

Prerequisite Modules: SSCI217.

Aim: To provide a scientific and practical understanding of the management of agricultural and horticultural soils for sustainable crop production.

Content: Soil testing and plant analysis as aids to making fertilizer recommendations and diagnosing nutrient deficiencies/imbalances. Fundamentals of fertilizer practice. Chemistry/biochemistry of nitrogen, phosphorus, potassium, magnesium, calcium, sulphur and micronutrients in soils in relation to their uptake and use by crops. Nature of soil acidity, tolerance of crops to acidity, use of lime and gypsum as ameliorants.

Practicals: Soil fertility evaluation involving a glasshouse experiment.

Assessment: 2 tests (20%), project report (30%); 3 h exam (50%).

DP Requirement: Not applicable

Agricultural and Environmental Soil Physics

SSCI353 P1   (36L-6T-36P-0S-50H-24R-0F-0G-8A-13W-16C)

Prerequisite Modules: SSCI217.

Aim: To provide a fundamental understanding of structural make-up of soils, soil-water relations and their applications in agriculture and the environment.

Content: Measurement of soil water and water flow. Soil physical properties in relation to hydrological processes; soil water management in irrigated agriculture. Factors influencing soil strength and consistency, the formation and stabilization of micro-and macrostructure. Salt affected soils and their reclamation. Sources and consequences of soil compaction and corrective measures.

Practicals: Laboratory and field equipment including permeameters, infiltrometers, pressure plate apparatus, tension tables, core samplers, ovens, etc.

Assessment: Two tests (20%); two laboratory project reports (30%); 3 h exam (50%).

DP Requirement: Not applicable

Environmental Soil Chemistry

SSCI373 P2   (36L-6T-36P-0S-50H-24R-0F-0G-8A-13W-16C)

Prerequisite Modules: SSCI217.

Aim: To provide an understanding of the causes, soil processes and consequences of contamination in soils.

Content: The major soil contaminants added to soils. Reactions of inorganic and organic contaminants with soils and soil components; factors affecting their mobility and/or degradation in soils; their effects on processes; management and amelioration of contaminated soils. Leaching losses from soils; principles and modelling of solute movement: factors affecting leaching and effects on groundwater pollution. Processes involved in gaseous emissions of nitrous oxides, ammonia and methane from soils. Extent and consequences of such losses.

Practicals: One field trip to Darvill sewage sludge dumping site, use of laboratory equipment like AAS, CNS autoanalysers, UV-VIS spectrophotometers, etc.
Assessment: Two tests (20%); two laboratory project reports (30%); 3 h exam (50%).
DP Requirement: Not applicable

Pedochemistry in the Environment
SSCI730 P1   (36L-8T-38P-0S-48H-22R-0F-0G-8A-13W-16C)
Prerequisite Requirement: 32C in Level-3 SSCI.
Aim: To provide an understanding of pedological and chemical processes which occur in the soil environment.
Content: Weathering & humification processes; movement of materials in soil and across landscapes; soils and archaeology; theories of soil formation; soil micromorphology; pedological modelling; X-Ray diffraction. Soil solution and colloidal chemistry; electrical double layer theory; adsorption phenomena; mineral solubility; ion exchange; redox equilibria; organic interactions with soil surfaces. Application in agriculture and environmental protection.
Practicals: Field trip to Darvill sewage sludge dumping site; AAS, CNS auto-analysers, UV-VIS spectrophotometers, etc.
Assessment: Two tests (25%); reports on practical work (25%); 3 h exam (50%).
DP Requirement: Not applicable

Soil Productivity Management
SSCI750 P1   (36L-8T-38P-0S-48H-22R-0F-0G-8A-13W-16C)
Prerequisite Requirement: 32C in Level-3 SSCI.
Aim: To provide an understanding varied aspects of soil productivity management.
Content: Soil quality indices. Nature & management of acid soils. Al chemistry in soil; lime as an ameliorant. Subsoil acidity & use of gypsum. Sustainable agriculture & soil productivity. Conservation agriculture, carbon sequestration, nutrient cycling & soil health; alternative agricultural practices. Waste management, biochar, composts & manures. Pesticides and their persistence on nutrient availability & soil productivity. Soil biology technologies and industrial applications.
Practicals: Three field tripsd. Laboratory practicals using AAS, CNS autoanalysers, UV-VIS spectrophotometers, etc.
Assessment: Two tests (25%), reports on practical work (25%); 3 h exam (50%).
DP Requirement: Not applicable

Soil Science Seminar
SSCI792 PY   (0L-0T-0P-160S-0H-0R-0F-0G-0A-26W-16C)
Prerequisite Modules: SSCI217.
Aim: To provide experience in researching and synthesizing scientific literature on a specific topic.
Content: Search for information in the scientific literature on an approved topic; prepare a scientific review paper; present the paper orally.
Assessment: Written review paper (70%), oral presentation (30%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam.

Research Project in Soil Science
SSCI793 PY   (0L-0T-320P-0S-160H-0R-0F-0G-0A-26W-48C)
Prerequisite Requirement: Admission to BSc (Hons) majoring in Soil Science or to Level 4 of BSc (Agric) majoring in Soil Science.
Aim: To provide experience in conducting of a research project and preparation of a scientific paper.
Content: Conduct an approved research project, prepare a scientific paper on the results, present the results orally.
Assessment: Written scientific paper (75%), oral presentation (25%).
DP Requirement: Not applicable.
Year-long Module. This module has no supplementary exam.

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Statistics
Offered in the School of Mathematics, Statistics and Computer Science

Introduction to Statistics
STAT130 PB WB   (39L-18T-18P-0S-63H-13R-0F-0G-9A-13W-16C)
Prerequisite Requirement: Higher Grade D or Standard Grade A for Matric Mathematics or NSC Level 4 Maths.
Aim: To introduce a wide range of statistical techniques required for the analysis of quantitative data.
Content: Descriptive statistical methods. Measures of central tendency and dispersion. Permutations and Combinations. Basic probability concepts. Discrete random variables and their properties: Bernoulli, Binomial, Poisson, Hypergeometric. Normal distributions. Point and interval estimation. Correlation and simple linear regression. Hypothesis tests for proportions, means and variances. Reporting on the output of appropriate statistical computing packages.
Assessment: Two tests and or practical assignments (35%); 3 h exam (65%).
DP Requirement: 35% Class mark, 80% attendance at tutorials.
Credit may not be obtained for both STAT130 and STAT370.

Statistical Methods
STAT140 P2 W2   (39L-18T-18P-0S-63H-13R-0F-0G-9A-13W-16C)
Prerequisite Requirement: At least 40% in MATH130 or 195.
Prerequisite Modules: STAT130.
Corequisite: MATH140 or 196.
Aim: To introduce the student to basic probability concepts and theory as well as nonparametric techniques.
Content: The axioms of probability. Conditional probability and Bayes' Theorem. Random variables, probability density functions and distribution functions. Expectation and variance of discrete and continuous random variables. Linear functions of a random variable. Discrete bivariate distributions. Tests of independence and homogeneity. Nonparametric methods: sign test, Wilcoxon signed rank test, Mann-Whitney test, Kruskal Wallis test, Friedman test.
Assessment: Two tests and or practical assignments (35%); 3 h exam (65%).
DP Requirement: 35% Class mark, 80% attendance at tutorials.

Sampling and Nonparametric Methods
STAT221 P1   (39L-18T-18P-0S-63H-13R-0F-0G-9A-13W-16C)
Prerequisite Requirement: 40% in one of MATH130, 134, 150 or 195.
Corequisite: STAT130.
Aim: To equip the student with the tools to design and effectively analyze the results of a sample drawn from a finite population. To introduce the student to nonparametric methods for survey data.
Content: Scope of sample surveys. Principles of questionnaire design. Estimation of sample size. Simple random sampling. Stratified random sampling. Cluster sampling Adaptive sampling. Ratio and regression estimation. Nonparametric techniques. Single and multiple sample data analysis techniques. Re-sampling techniques. Computerbased exercises on the above topics.
Assessment: Two tests (20%), practical assignments (10%); 3 h exam (70%).
DP Requirement: 35% Class mark, 80% attendance at practicals and tutorials. Completion of all assignments.
Credit will not be given for both STAT221 and STAT395. (This will not apply to students who passed STAT221 in 2014 or earlier). This module is not available to Statistics majors.

Experimental Design and Analysis
STAT222 P2 W2   (39L-18T-18P-0S-63H-13R-0F-0G-9A-13W-16C)
Prerequisite Requirement: 40% in one of MATH130, 134, 150 or 195.
Prerequisite Modules: STAT130.
Aim: To provide the skills necessary to analyze & summarize various types of data with an emphasis on experimental design. Stress will be placed on statistical reasoning & applications, rather than derivation of theoretical details.

Content: Analysis of single, two- & multi-sample problems, including z-tests, t-tests and ANOVA. Experimental units. Error reduction by blocking, including randomized complete blocks & Latin square designs. Use of more than one square. Split-plot, split-split-plot and split-block designs. Factorial treatment structures. Covariance analysis. General linear methods. Nonparametric methods. Analysis of binary or count data. Computer-based exercises.
Assessment: Two tests (30%); 3 h exam (70%).
DP Requirement: 35% Class mark, 80% attendance at tutorials.

Probability Distributions
STAT230 P1 W1   (39L-18T-18P-0S-63H-13R-0F-0G-9A-13W-16C)
Prerequisite Modules: MATH140 or 196; STAT140.
Corequisite: MATH212.
Aim: To introduce the student to univariate and bivariate distributions.
Content: Discrete probability distributions. Hypergeometric, Binomial, Poisson, Negative Binomial, Continuous probability distributions. Normal, Gamma family, Beta, t-distribution, F-distribution. Transformation of random variables. Moments and generating functions: probability-, moment- and factorial generating functions. Bivariate distributions: marginal and conditional distributions, moments and correlation. Bivariate Normal distribution.
Assessment: Two tests and or practical assignments (35%); 3 h exam (65%)
DP Requirement: 35% Class mark, 80% attendance at tutorials.

Statistical Inference
STAT240 P2 W2   (39L-18T-18P-0S-63H-13R-0F-0G-9A-13W-16C)
Prerequisite Requirement: 40% in MATH212.
Prerequisite Modules: STAT230.
Corequisite: MATH251.
Aim: To introduce the student to statistical inference.
Content: Sampling distributions. Point estimation: maximum likelihood, method of moments, ordinary least squares. Properties of estimators. Interval estimation: Hypothesis testing: likelihood ratio test, best critical regions, uniformly most powerful tests. Least squares estimation and inference for the simple linear regression model. Principles of Bayesian estimation.
Assessment: Two tests and or practical assignments (35%); 3 h exam (65%)
DP Requirement: 35% Class mark, 80% attendance at tutorials.

Data Mining using Machine Learning
STAT243 PC1 WC1   (39L-18T-18P-0S-39H-13R-0F-0G-33A-15W-16C)
 Prerequisite Modules: STAT140.
Aim: To introduce machine learning and data mining techniques that will be needed to discover structure inside unstructured data, extract meaning from noisy data, discover patterns, correlations, and ultimately predict customer/market behaviour and industrial as well as natural processes.
Content: Processes of data mining which include data selection, cleaning and coding, using statistical pattern recognition and machine learning techniques, and reporting and visualizing the generated structures. Prepare and explore data for analytical model development. Create and select features for predictive modelling. Develop a series of supervised learning models based on different techniques such as decision tree, ensemble of trees (forest and gradient boosting), neural networks, and support vector machines. Build segments for business applications.
Assessment: Tests and SAS or R based practical assignments (35%) and one 3 hour exam (65%).
DP Requirement: 80% attendance.

Introduction to Financial Mathematics
STAT270 W1   (39L-39T-0P-0S-59H-16R-0F-0G-7A-13W-16C)
 Prerequisite Modules: MATH140 or 196; STAT140.
 Corequisite: MATH212, STAT230.
 Aim: To introduce some key concepts in financial mathematics.

Content: Compound and simple interest. Nominal and effective interest rates, Single and multiple cash flow problems, bond repayment problems, binomial trees, elementary contingent claim pricing problems. Probability concepts and their application to financial mathematics problems. The concept of risk and how derivative contracts can be created to mitigate this risk. Introduction to the Black-Scholes pricing equation.
Assessment: tests and/or assignments (30%); 3 h exam (70%).
DP Requirement: 35% Class mark.

Linear Models
STAT301 P1 W1   (39L-36T-0P-0S-65H-13R-0F-0G-7A-13W-16C)
Prerequisite Modules: MATH212 and 251, (STAT240 or BMET314).
Aim: To introduce the student to the theory and application of the general linear model.
Content: Topics from linear algebra. The Gauss-Markov Theorem. The general linear model of full rank and less than full rank. Regression analysis. Analysis of variance and covariance.
Assessment: Two tests (30%); 3 h exam (70%).
DP Requirement: 30% Class mark, 80% attendance at tutorials.

Biostatistics Methods
STAT305 P2 W2   (39L-36T-0P-0S-65H-13R-0F-0G-7A-13W-16C)
Prerequisite Modules: STAT230 and (STAT301 or BMET314).
Aim: To provide the student with a thorough understanding of biostatistics and to expose the student to a range of practical problems in that area.
Content: Introduction to epidemiology including the standardization of mortality rates, morbidity studies and clustering of diseases. Clinical trials. Cohort studies. Survival analysis.
Practicals: Computer-based exercises on the above topics.
Assessment: Two tests (20%), practicals (10%); 3 h exam (70%).
DP Requirement: 30% Class mark, 80% attendance at practicals.

Applied Statistics
STAT330 P2 W2   (39L-36T-0P-0S-65H-13R-0F-0G-7A-13W-16C)
Prerequisite Modules: STAT301.
Aim: To provide the student with practical applications of statistical topics.
Content: Applied regression analysis. Analysis of variance and experimental design. Quality control. Acceptance sampling. Nonparametric methods.
Assessment: Two tests (30%); 3 h exam (70%).
DP Requirement: 30% Class mark, 80% attendance at tutorials.

Random Processes
STAT350 P2 W2   (39L-36T-0P-0S-65H-13R-0F-0G-7A-13W-16C)
Prerequisite Modules: STAT395.
Aim: To introduce the student to the theory and applications of stochastic models.
Content: Broad classification of stochastic processes. Markov chains. Birth and death processes. Queueing theory. The Poisson process. Conditional expectations and martingales. Branching processes. Renewal theory. Time series. Loss distributions and risk models.
Assessment: Two tests (30%); 3 h exam (70%).
DP Requirement: 30% Class mark, 80% attendance at tutorials.

Engineering Statistics
STAT370 H1   (18L-13T-5P-0S-33H-5R-0F-0G-6A-13W-8C)
Prerequisite Requirement: DP in MATH248.
Aim: To introduce engineering students to elementary probability theory and statistical methods.

Content: Elementary probability, standard distributions, bivariate distributions. Estimation of parameters and testing of hypotheses. Regression analysis.
Assessment: Tests (30%); 2 h exam (70%).
DP Requirement: 30% Class mark, 80% attendance at tutorials.
Offered only at Howard College to Engineering students. Credit may not be obtained for both STAT370 and STAT130.

Financial Modelling and Application
STAT385 W1   (39L-13T-26P-0S-35H-10R-0F-0G-37A-13W-16C)
Prerequisite Modules: MATH251, STAT240, STAT270.
Aim: To introduce students to financial modelling and its application using the R package.
Content: Autoregressive and moving average time series models, Garch models, Econometric models, Markowitz portfolio techniques, Vector time series models, An introduction to the R package.
Assessment: Practical assignment (using R) (10%), 2 tests (20%); 3 h exam (70%).
DP Requirement: 30% class mark, 80% attendance at both tutorials and practicals.

Financial Mathematics
STAT390 W2   (39L-36T-0P-0S-60H-18R-0F-0G-7A-13W-16C)
Prerequisite Modules: STAT385.
Aim: To introduce students to advanced financial mathematics concepts that are needed to price financial products in an arbitrage free manner.
Content: Binomial lattice and Brownian motion model structures. Arbitrage free pricing of derivative claims. Pricing of Options, futures and interest rate derivatives. An introduction to stochastic calculus concepts.
Assessment: Class mark (30%); 3 h exam (70%).
DP Requirement: 30% class mark, 80% attendance at tutorials.

Applied Probability Models
STAT395 P1 W1   (39L-13T-26P-0S-35H-10R-0F-0G-37A-13W-16C)
Prerequisite Modules: STAT240.
Aim: To introduce the student to basic Bayesian statistics and probability sampling techniques as commonly used by government departments, industry and commerce.
Content: Bayesian statistics concepts; Probability Sampling techniques for estimating means, totals and proportions, including the following sampling procedures: Simple random sampling, stratified sampling, cluster sampling, systematic sampling, PPS sampling. Re-sampling techniques: bootstrap, jackknife. Nonparametric methods. Computer based practicals will be a key feature of this module.
Assessment: Class mark (30%); 3 h exam (70%).
DP Requirement: 30% class mark, 80% attendance at both tutorial and practical sessions.
Credit may not be obtained for both STAT221 and STAT395. (This will not apply to students who passed STAT221 in 2014 or earlier.)

Time Series & Forecasting
STAT710 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)
Aim: To provide the student with a thorough understanding of time series methodology and forecasting and to expose the student to a range of practical problems in those areas.
Content: Descriptive techniques for time series. Probability models for time series. Estimation in the time domain. Principles of forecasting. A miscellany of topics in time series analysis which may include, *inter alia*, stationary processes in the frequency domain, spectral analysis, bivariate processes and state-space modelling.
Practicals: Tests and assignment (40%); 3 h exam (60%)
Assessment: Tests and assignment (40%); 3 h exam (60%).
DP Requirement: 40% class mark and 80% attendance
Offered in either Semester 1 or 2.

Bayesian Inference

STAT711 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)

Aim: To introduce the student to Bayesian theory and methods.

Content: Inference and estimation using Bayesian methods.

Assessment: Tests and assignment (40%); 3 h exam (60%).

DP Requirement: 40% class mark and 80% attendance.

Offered in either Semester 1 or 2.

Regression Diagnostics

STAT712 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)

Aim: To equip the student with regression diagnostic techniques to employ when fitting regression models to data and checking on the adequacy of the model.

Content: Checking the linear model assumptions of normality, independent errors and constant variance. Transformations of variables. The problem of multicollinearity. Other diagnostic tests including Cook's D, DIFFITS and DIFFBETAS.

Assessment: Tests and assignment (40%); 3 h exam (60%).

DP Requirement: 40% class mark and 80% attendance.

Offered in either Semester 1 or 2.

Econometrics

STAT713 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)

Aim: To enable the student to understand the theory and practical applications of econometric methods.

Content: Dummy variables. Simultaneous equation models. Error in variables. Distributed lags. Heteroscedasticity, autocorrelation, multicollinearity, Cointegration, Inference and estimation using Bayesian methods

Assessment: Tests and assignment (40%); 3 h exam (60%).

DP Requirement: 40% class mark and 80% attendance.

Offered in either Semester 1 or 2.

The Generalized Linear Model

STAT714 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)

Aim: To provide the student with a thorough understanding of generalized linear models and to expose the student to a range of practical problems in that area.

Content: The principles of model fitting. Exponential family of distributions and generalized linear models. Estimation and inference for generalized linear models. Quasi likelihood methods, Mixed effects and generalised estimating equations; Contingency tables and log-linear models. A miscellany of additional topics in generalized linear models.

Practicals: Computer-based exercises on the above topics.

Assessment: Tests and assignment (40%); 3 h exam (60%).

DP Requirement: 40% class mark and 80% attendance.

Offered in either Semester 1 or 2.

Advanced Probability Theory

STAT716 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)

Aim: To expose the student to a measure-theoretic approach to modern probability theory.

Content: Advanced probability theory with the relevant measure theory.

Assessment: Tests and assignment (40%); 3 h exam (60%).

DP Requirement: 40% class mark and 80% attendance.

Offered in either Semester 1 or 2.

Queueing Theory

STAT717 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)

Aim: To give a systematic account of the basic formulae of queueing theory and their applications.

Content: An introduction to queueing theory. Single-server exponential queueing models. Simple Markovian birth-death queueing models. Simulations and application.
Assessment: Tests and assignment (40%); 3 h exam (60%).
DP Requirement: 40% class mark and 80% attendance.
Offered in either Semester 1 or 2.

Stochastic Processes
STAT718 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)
Aim: To establish the theoretical foundations of stochastic models and the applications thereof.
Content: Queueing theory. Renewal processes. Markov processes. Brownian motion.
Assessment: Tests and assignment (40%); 3 h exam (60%).
DP Requirement: 40% class mark and 80% attendance.
Offered in either Semester 1 or 2.

Sampling Theory
STAT719 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)
Aim: To investigate principles of sampling by focusing on various survey procedures commonly used by government departments, in industry and in commerce.
Content: Simple random sampling. Estimating a mean, total and a proportion. Ratio estimators. Cluster sampling. Stratified sampling. Systematic sampling.
Assessment: Tests and assignment (40%); 3 h exam (60%).
DP Requirement: 40% class mark and 80% attendance..
Offered in either Semester 1 or 2.

Time Series Analysis
STAT721 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)
Aim: To provide a thorough understanding of the theory and computer applications of time series techniques.
Content: Box-Jenkins ARIMA and SARIMA models. Garch and Arch models. Transfer function models. Spectral analysis. Extreme value theory and applications.
Assessment: Tests and assignment (40%); 3 h exam (60%).
DP Requirement: 40% class mark and 80% attendance.
Offered in either Semester 1 or 2.

Advanced Topics in Statistics
STAT723 PC WC   (29L-10T-0P-0S-102H-13R-0F-0G-6A-13W-16C)
Aim: To investigate some statistical topics of current research interest.
Content: Topics in statistics, not included in the list of specified modules or additional aspects of the listed modules (e.g. multivariate analysis, time series analysis, econometrics), may be offered.
Assessment: Tests and assignment (40%); 3 h exam (60%).
DP Requirement: 40% class mark and 80% attendance
Offered in either Semester 1 or 2.

Mixed Models & Spatial Statistics
STAT730 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)
Aim: To provide the student with a basic theory of linear mixed models and the particular extension to spatial and temporal forms of covariance.
Content: Stationary and non-stationary mixed models: linear and generalized mixed models as well as longitudinal data analysis. Kriging equations for prediction. Co-kriging and validation. Practical examples using various computer packages.
Practicals: Computer-based exercises on the above topics.
Assessment: Tests and assignment (40%); 3 h exam (60%).

DP Requirement: 40% class mark and 80% attendance
Offered in either Semester 1 or 2.

Risk Management
STAT733 PC WC   (39L-18T-18P-0S-49H-13R-0F-16G-7A-13W-16C)
Aim: To develop statistical concepts that will be needed to manage risk in a commercial
setting. The study and implementation of appropriate statistical software suitable for such
analysis will also form a major component of this course.
Content: Binomial lattice pricing/black scholes option pricing formula; survival analysis techniques, credit scoring-methods, discriminant analysis, decision trees.
Practicals: SAS based practicals.
Assessment: Tests and assignments (40%) and one 3 hour exam (60%)
DP Requirement: Class mark 40%, 80% Attendance
Offered in either Semester 1 or 2.

Experimental Design
STAT740 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)
Aim: To provide the student with a basic theory of experimental design, particularly in incomplete blocks and in the design and analysis of complex experiments.
Content: Partial confounding in factorials. Fractional replication. Incomplete block designs and the recovery of interblock information. Incomplete blocks from a mixed model perspective. Experimental design for repeated measures including cross-overs. Alpha lattices & designs for spatial models. Practical analysis of complex designs using SAS and GENSTAT.
Practicals: Computer-based exercises on the above topics.
Assessment: Tests and assignment (40%); 3 h exam (60%)
DP Requirement: 40% class mark and 80% attendance
Offered in either Semester 1 or 2.

Simulation with R
STAT741 PC WC   (39L-18T-18P-0S-63H-13R-0F-0G-9A-13W-16C)
Aim: To study the theory and practical applications of simulation methods using R as a programming language.
Content: Random number generation. Monte Carlo integration. Generating discrete random variables. Generating continuous random variables. Discrete event simulation. Elementary bootstrapping techniques. Variance reduction. Statistical validation techniques. Practical computing using R.
Assessment: Tests and assignment (40%); 3 h exam (60%)
DP Requirement: 40% class mark and 80% attendance
Offered in either Semester 1 or Semester 2.

Customer Segmentation Methods
STAT743 WC, PC   (39L-18T-18P-0S-39H-13R-0F-26G-7A-13W-16C
Aim: To introduce statistical techniques that will be needed to analyse the interdependence of
variables/observations in big business data.
Content: Review of multivariate basic concepts; segment based descriptive models; Cluster
analysis; Multidimensional scaling and correspondence analysis and predictive
models in segments.
Practicals: SAS based practicals.
Assessment: Tests and SAS based practical assignments (40%) and one 3 hour exam (60%)
DP Requirement: class mark 40%, 80%attendance
Offered in either Semester 1 or Semester 2

Applied Multivariate Analysis
STAT751 PC WC   (39L-18T-18P-0S-65H-13R-0F-0G-7A-13W-16C)

Aim: To investigate multivariate statistical methods: Data reduction techniques, grouping and dependence amongst variables.

Content: Aspects of Multivariate analysis. Principal components. Factor analysis. Discrimination & classification. Canonical correlation. Clustering.

Assessment: Tests and assignment (40%); 3 h exam (60%).

DP Requirement: 40% class mark and 80% attendance

Offered in either Semester 1 or Semester 2.

Recent Topics in Statistics
STAT752 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)

Aim: To provide the student with knowledge and skills in selected topics in Statistics.

Content: Miscellaneous topics from areas in Statistics which are of current interest to researchers and practitioners.

Practicals: Computer-based exercises.

Assessment: Tests and assignment (40%); 3 h exam (60%).

DP Requirement: 40% class mark and 80% attendance

Offered in either Semester 1 or 2.

Special Topics in Biostatistics
STAT753 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)

Aim: To provide the student with knowledge and skills in special topics in Biostatistics.

Content: Special Biostatistics topics from the areas in Biostatistics which may not have been covered by other honours courses offered.

Practicals: Computer-based exercises.

Assessment: Tests and assignment (40%); 3 h exam (60%).

DP Requirement: 40% Class mark, 80% attendance.

Offered in either Semester 1 or 2.

Nonparametric Inference
STAT754 PC WC   (39L-18T-18P-0S-66H-13R-0F-0G-6A-13W-16C)

Aim: To provide the student with knowledge and skills in nonparametric statistical theories and methods.

Content: The general theory of nonparametric statistics, including order statistics, theory of ranks, U-statistics in nonparametric estimation and testing, linear rank statistics and their application to location and scale problems; goodness-of-fit, and other distribution-free procedures.

Practicals: Computer-based exercises.

Assessment: Tests and assignment (40%); 3 h exam (60%).

DP Requirement: 40% Class mark, 80% attendance.

Offered in either Semester 1 or 2.

Project in Statistics
STAT795 PY WY   (5L-5T-0P-4S-306H-0R-0F-0G-0A-26W-32C)

Aim: To allow and enable the student to work independently on a statistical topic of an applied or theoretical nature.

Content: A project of either theoretical or practical nature from a list of suggested topics under the guidance of a supervisor will be undertaken, a typed report submitted and an oral presentation given.

Assessment: Oral presentations: Project proposal and research findings (15%), written report (85%).

DP Requirement: Not applicable.

Year-long module.

This module has no supplementary examination.

MODULES FROM OTHER COLLEGES

IN THE COLLEGE OF HUMANITIES

IsiZulu Studies

Offered in the School of Arts

Basic IsiZulu Language Studies A
ZULN101 H1 P1 WB   (39L-10T-19P-0S-74H-5R-10F-0G-7A-13W-16C)
Prerequisite Requirement: Open to students who have not written an Nguni mother tongue Grade 12 examination.
Aim: To achieve elementary fluency in both the oral and the written language.
Content: This module introduces basic grammar, history and culture of the amaZulu. Lectures combine an academic study of IsiZulu with the use of a communicative method of language learning.
Assessment: Class work: 40%   Examination: 60%
DP Requirement: Students must submit of all written work on time and must comply with the attendance requirements for the School of IsiZulu Studies.
Core module for the major in IsiZulu Studies

IN THE COLLEGE OF LAW AND MANAGEMENT STUDIES

Accounting

Offered in the School of Accounting, Economics & Finance

Accounting 101
ACCT101 P1 W1   (39L-19T-0P-0S-36H-11R-0F-0G-55A-15W-16C)
Prerequisite Requirement: Nil
Content: The module provides the student with an understanding of the role of accounting in business, various forms of business entities, the conceptual framework and the theory underpinning certain International Financial Reporting Standards and provides the student with the ability to record certain financial transactions and to prepare basic financial statements in accordance with IFRSs and the Companies Act.
Assessment: Class Mark (50%), Examination (50%)
DP Requirement: A class mark of 40%

Accounting 103
ACCT103 P2 W2 H2   (39L-19T-0P-0S-36H-11R-0F-0G-55A-13W-16C)
Prerequisite Requirement: A minimum final mark of 40% in Accounting 101 or a minimum final mark of 50% in Financial Reporting 1A.

Content: The objectives of the module are to provide students with the business knowledge necessary to formulate a successful business plan; to expose students to sound business controls and tools for the running of a successful business; and to introduce students to basic taxation in a small business.

Assessment: Class Mark (33%), Examination (67%)

DP Requirement: A 40% class mark, an 80% attendance of tutorials and the satisfactory completion of the project.

Economics

Offered in the School of Accounting, Economics & Finance

Principles of Microeconomics

ECON101 H1 P1 W1 (39L-0T-0P-0S-75H-40R-0F-0G-6A-13W-16C)

Prerequisite Requirement: Nil

Content: Introductory economic concepts including the principles of supply and demand, the efficient production of goods, market structures under perfect competition and monopoly. The markets for labour, capital and land are analysed and the manner in which income and wealth is distributed.

Assessment: 3 tests (40%), 1 three-hour examination (60%)

DP Requirement: Students must write all class tests and obtain a class record of at least 40%.

Principles of Macroeconomics

ECON102 H2 P2 W2 (39L-0T-0P-0S-75H-40R-0F-0G-6A-13W-16C)

Prerequisite Requirement: Nil

Content: An introduction to macroeconomics. The operation of the money market is examined, and the main components of expenditure (consumption, investment, government spending and net exports) are used to build simple macroeconomic models. Fiscal and monetary policy tools and their ability to influence key macroeconomics concerns of inflation, unemployment and growth are assessed.

Assessment: 3 tests (40%), 1 three-hour examination (60%)

DP Requirement: Students must write all class tests and obtain a class record of at least 40%.

Intermediate Macroeconomic & Applications

ECON201 H1 P1 W1 (39L-4T-0P-0S-61H-50R-0F-0G-6A-13W-16C)

Prerequisite Requirement: Economics 102

Content: Intermediate macroeconomics and applications. This module covers theories of income determination and employment. These are examined in the context of the analysis of goods and money markets as well as in an aggregate demand/aggregate supply framework. Fiscal and monetary policies and their impact on output, employment and prices are analysed, as are trade-offs between inflation and unemployment. Key macroeconomic issues are assessed in the context of developed and developing economies.

Assessment: Tests/Assignments (40%), Examination (60%)

DP Requirement: Students must write all class tests and obtain a class record of at least 40%.

Intermediate Microeconomics & Applications

ECON202 H2 P2 W2 (39L-4T-0P-0S-61H-50R-0F-0G-6A-13W-16C)

Prerequisite Requirement: Economics 101

Content: Intermediate microeconomics and applications. This module covers intermediate microeconomic theory, its application to solving real-world economic problems and the analysis of policy-related issues. Traditional theories of consumer (utility) behaviour and production (output and profit optimisation) behaviour are examined. In addition, students are exposed to modern theories – such as game theory and transaction cost theory. Applications include the analysis of risk in consumption, investment and insurance decisions and the efficient allocation of resources and output under welfare economics.

Assessment: Tests/assignments (40%), Examination (60%)

DP Requirement: Students must write all class tests and obtain a class record of at least 40%.

Environmental Economics
ECON302 W1   (30L-10T-0P-0S-76H-40R-0F-0G-4A-13W-16C)
Prerequisite Requirement: Economics 202
Content: This module addresses the nature and causes of modern environmental problems and the application of microeconomic analysis to these problems, with particular reference to natural resource depletion and pollution. Ecology and sustainable development are examined, while environmental issues in South Africa receive particular attention.
Assessment: Assignments/tests (40%), Examination (60%)
DP Requirement: Write all tests and submit all assignments
*options offered at various campuses will depend on staff availability and student numbers.
Details will be given each semester by the Economics 3 co-ordinators.

Macroeconomics
ECON303 W1   (30L-10T-0P-0S-76H-40R-0F-0G-4A-13W-16C)
Prerequisite Requirement: Economics 202
Content: The module covers a wide range of current economic issues and problems of relevance to South Africa. During any given year selected global economic issues will be analysed. Critical application of economic theory to key global issues is essential. Students will learn to analyse these issues and identify how they affect policy decisions.
Assessment: Assignments/tests (40%), Examination (60%)
DP Requirement: Write all tests and submit all assignments
*options offered at various campuses will depend on staff availability and student numbers.
Details will be given each semester by the Economics 3 co-ordinators.

International Economics
ECON306 W1   (30L-10T-0P-0S-76H-40R-0F-0G-4A-13W-16C)
Prerequisite Requirement: Economics 201 and 202
Content: The main focus of this module is on international trade theory and commercial policy, including tariff and nontariff barriers. The module also includes a briefer coverage of international finance and exchange rate policy. Questions of economic integration are covered and a brief review of illegal international transactions is included.
Assessment: Assignments/tests (40%), Examination (60%)
DP Requirement: Write all tests and submit all assignments
*options offered at various campuses will depend on staff availability and student numbers.
Details will be given each semester by the Economics 3 co-ordinators.

Maritime Transport Economics
ECON307 W1   (30L-10T-0P-0S-76H-40R-0F-0G-4A-13W-16C)
Prerequisite Requirement: Economics 202
Content: This module will examine the organisation of the sea transport industry and the major factors affecting its demand, supply, price and cost in the context of the extreme volatility that has characterised this dominant international transport mode in recent decades. Maritime transport policies and their impact on markets are a particular focus of attention. The module is set in the context of Southern Africa and the Indian Ocean Rim.
Assessment: Assignments/tests (40%), Examination (60%)
DP Requirement: Write all tests and submit all assignments
*options offered at various campuses will depend on staff availability and student numbers.
Details will be given each semester by the Economics 3 co-ordinators.

Public Economics
ECON308 W2   (30L-10T-0P-0S-76H-40R-0F-0G-4A-13W-16C)

Prerequisite Requirement: Economics 202

Content: This module examines the broad role of the state in modern mixed economies. It addresses the theory and effects of government expenditure, taxes and transfer payments. Both efficiency and equity considerations of the public sector budgets are assessed.

Assessment: Assignments/tests (40%), Examination (60%)

DP Requirement: Write all tests and submit all assignments

*options offered at various campuses will depend on staff availability and student numbers. Details will be given each semester by the School of Economics and Finance.

Macroeconomic Policy in SA

ECON309 P2 W2 H2   (30L-10T-0P-0S-76H-40R-0F-0G-4A-13W-16C)

Prerequisite Requirement: Economics 201

Content: The theoretical foundations of macroeconomics are used to understand the objectives of and conflicts in macroeconomic policy. The module will examine monetary policy and the S.A. financial system, as well as fiscal and budgetary policy. Open-economy macroeconomic issues will be analysed, as will the co-ordination between monetary, fiscal and balance of payments policies.

Assessment: Assignments/tests (40%), Examination (60%)

DP Requirement: Write all tests and submit all assignments

*options offered at various campuses will depend on staff availability and student numbers.

Details will be given each semester by the Economics 3 co-ordinators.

Labour Economics

ECON311 P2 W2   (30L-10T-0P-0S-76H-40R-0F-0G-4A-13W-16C)

Prerequisite Requirement: Economics 202

Content: Key issues in the SA labour market are addressed, including wage determination, inequality and discrimination, affirmative action, unemployment, labour relations and globalisation. The module examines critically the tools that economists have used to analyse these issues and explores current policy initiatives and policy debates in the SA economy.

Assessment: Assignments/tests (40%), Examination (60%) **DP**

Requirement: Write all tests and submit all assignments.

*options offered at various campuses will depend on staff availability and student numbers.

Details will be given each semester by the Economics 3 co-ordinators.

History of Economic Thought

ECON312 W2   (30L-10T-0P-0S-76H-40R-0F-0G-4A-13W-16C)

Prerequisite Requirement: Economics 201 and 202

Content: This module is a brief introduction to the evolution of the fundamental ideas, which have Scholastic origins all the way to the Marginalist Revolution of the latter 19th century. The student will also get exposure to alternative schools of thought, like the German Historical School and the American Institutional School. The module concludes by examining the impact of these ideas on twentieth century economic, political and social thought. The object of the module is to help students understand that nobody has a monopoly on the truth, and that different groups contributed to our rich intellectual, cultural and material heritage.

Assessment: Assignments/tests (40%), Examination (60%)

DP Requirement: Write all tests and submit all assignments

* options offered at various campuses will depend on staff availability and student numbers.

Details will be given each semester by the Economics 3 co-ordinators.

Quantitative Economics

ECON314 H2 P1 W2   (30L-10T-0P-0S-76H-40R-0F-0G-4A-13W-16C)

Prerequisite Requirement: Economics 201 and 202

Content: This module will cover the essential elements of the application of economic theory to real-world data using the tools of mathematics and econometrics at a basic level. A brief introduction to the necessary mathematical tools lays the foundation for the estimation and interpretation of single-equation models with continuous dependent variables. The emphasis will be on practical application rather than theory.

Assessment: Assignments/tests (40%); Examination (60%)

DP Requirement: Students must attend 75% of practical sessions, write all tests and submit all assignments. **Core module**

Mathematical Economics

ECON315   (39L-9T-0P-0S-48H-48R-0F-0G-16A-15W-16C)

Prerequisite requirement: Successful completion of ECON201 AND ECON202

Aim: To equip students with a solid theoretical foundation of how mathematics can be used in economics such as understanding consumer and firm behaviour and the economy in general.

Content: The module covers the application of matrices, differential and integral calculus to a range of economic problems such as comparative statics, constrained and unconstrained optimisation and dynamics of economic systems. It then considers the economic applications of differential and difference equations.

Assessment: Class mark (50%), Examinations (50%)

DP requirement: None

Applied Microeconomics

ECON330 P2 W1   (30L-10T-0P-0S-76H-40R-0F-0G-4A-6W-16C)

Prerequisite Requirement: Economics 202

Aim: To develop the analytical skills of learners in the application of micro-economic theory using graphs, algebra and elementary calculus.

Content: The theory of consumer behaviour and demand, the theory of production and cost, pricing and market structures, the theory of the firm, inter-temporal choice, asset markets and consumption under uncertainty.

Assessment: Assignments/tests 40%; Exam 60%

DP Requirement: Write all tests and submit all assignments.

*options offered at various campuses will depend on staff availability and student numbers.

Details will be given each semester by the Economics 3 co-ordinators.

Monetary Economics

ECON340 P1   (30L-10T-0P-0S-76H-40R-0F-0G-4A-6W-16C)

Prerequisite Requirement: Economics 201

Aim: To develop a conceptual framework which will enable learners to critically analyse national and international monetary behaviour and markets.

Content: Demand for money, supply of money, level and structure of interest rates, inflation, balance of payments and exchange rates, the transmission mechanism, South African monetary policy. **Assessment:** Assignments/tests (40%), Examination (60%) **DP Requirement:** Write all tests and submit all assignments.

*options offered at various campuses will depend on staff availability and student numbers.

Details will be given each semester by the Economics 3 co-ordinators.

International Trade

ECON360 P2   (30L-10T-0P-0S-76H-40R-0F-0G-4A-13W-16C)

Prerequisite Requirement: Economics 102 and Economics 202

Aim: To enable learners to understand why countries trade and the impact of international trade in the world economy. The nature and consequences of trade policies, the balance of payments and the operation of the foreign exchange are also examined.

Content: International Trade Theory and Policy, Exchange Rate Determination and Policy, South African Applications.

Assessment: Assignments/tests 40%; Exam 60%

DP Requirement: Write all tests and submit all assignments.

*options offered at various campuses will depend on staff availability and student numbers.
Details will be given each semester by the Economics 3 co-ordinators.

Development Economics

ECON370 P1 W2   (30L-10T-0P-0S-76H-40R-0F-0G-4A-6W-16C)
Prerequisite Requirement: Economics 101 and Economics 102
Aim: To study the theory of economic development and growth, addressing issues specific to developing countries.
Content: Theories of development and globalization, population growth, the role of the state, foreign aid and investment, agriculture and industry.
Assessment: Assignments/tests 40%; exam 60%
DP Requirement: Write all tests and submit all assignments.
*options offered at various campuses will depend on staff availability and student numbers.
Details will be given each semester by the Economics 3 co-ordinators.

Information Systems & Technology

Offered in the School of Management, IT & Governance

IS & T for Business

ISTN101 W1 P1   (29L-8T-19P-0S-55H-44R-0F-0G-5A-13W-16C)
Prerequisite Requirement: None
Aim: To provide an understanding of organisational systems, planning, and decision processes, and how information and systems are used in organisations.
Content: Organisational Systems (business processes, management levels, business decisions); Systems theory and concepts, including systems components and relationships; Information systems in organisations (decision-support, roles of people using, developing and managing systems, societal and ethical issues relating to IS & T use, business applications of spreadsheets and databases, types of information systems in business); The Systems Development Life Cycle, Information system security; E-Business.
Practicals: Computer-based exercises on the above topics.
Assessment: 2 h exam (50%), tests / assignments (50%).
DP Requirement: Students must obtain a class record of at least 40%.

Development and Applications Fundamentals

ISTN103 W2 P2   (29L-8T-19P-0S-68H-30R-0F-0G-6A-13W-16C)
Prerequisite Requirement: None (Note that 101 and 102 are pre-requisites for level 2 IST modules).
Aim: To provide an introduction to Systems Analysis and Design, Web Page Design and Business Applications.
Content: Information Systems Management; Systems Analysis and Design; Human-Computer Interaction; Web-Page Design, Web-Page Creation; Business Applications for packaged software, Systems Auditing.
Practicals: Computer-based exercises on the above topics.
Assessment: 2 hour examination (50%), tests / assignments (50%).
DP Requirement: Students must obtain a class record of at least 40%.

Systems Analysis and Design

ISTN211 W1, P1   (29L-10T-3P-0S-51H-62R-0F-0G-5A-13W-16C)
Prerequisite Requirement: (ISTN101 or COMP100) and (COMP102)
Aim: To provide students with the knowledge and skills to apply the methods, tools and techniques of analysis and design to business and information technology problems. The module provides the foundation for the major project in the next level of study.

Content: Approaches to systems development (Structured and Object-Oriented); Systems Analysis (Requirements discovery, Modelling systems requirements, Feasibility analysis); Systems Design (Application architecture, output, input and user interface design).
Practicals: Computer-based exercises on the above topics.
Assessment: 3 h exam (60%), tests / assignments (40%). Students must obtain at least 40% in the examination paper.
DP Requirement: Students must obtain a class record of at least 40%.

Databases and Programming
ISTN212 W2, P2   (29L-10T-16P-0S-40H-60R-0F-0G-5A-13W-16C)
Prerequisite Requirement: (ISTN101 or COMP100) and (COMP102)
Aim: To enable students to develop skills in modelling, designing and implementing databases, designing, developing, testing and implementing programs and using databases in application programs. A foundation for the major project in Year 3 is provided.
Content: Databases (Models and concepts, Normalization, Design, Queries and Reports, Features and capabilities, Implementation). Programming (Fundamentals, Algorithms, Control structures, Traditional, Event Driven and OO, Implementation including DB connectivity, Verification and validation).
Practicals: Computer-based exercises on the above topics.
Assessment: 3 h exam (60%), tests / assignments (40%). Students must obtain at least 40% in the examination paper.
DP Requirement: Students must obtain a class record of at least 40%.

Advanced Systems Analysis and Design
ISTN3SA W1 P1   (39L-11T-6P-0S-43H-55R-0F-0G-6A-15W-16C)
Prerequisite Requirement: ISTN211 and ISTN212, and at least 40% in Introductory programming for information systems or an approved equivalent module
Aim: To provide students with the knowledge and skills to analyse and design usable business information systems using the OO methodology.
Content: Object-oriented systems analysis and design covering modelling of requirements, object interaction, specification of operations and control, architectural design, detailed design, class design, data management design and human-computer interaction.
Practicals: Exercises on the above topics.
Assessment: 3 hour examination (60%), tests/assignments (40%). Students must obtain at least 40% for the examination.
DP Requirement: Students must obtain a class record mark of at least 40%.

Applied Systems Implementation 1
ISTN3ASW1 P1   (30L- 5T-20P-0S-82H-10R-0F-8G-5A-15W-16C)
Prerequisite Requirement: ISTN211and ISTN212, and at least 40% in Introductory Programming for Information

Systems or an approved equivalent module
Corequisite: Advanced Systems Analysis and Design
Aim: To enable students to manage information systems projects and prepare them for actual project management in the capstone Major project module. Students are also equipped to use systems analysis, design and development skills to provide a software solution to business oriented.
Content: Part A: Project management covering the following aspects: Project Management Life Cycle; The Human Side of PM; Managing Project Risk; Scheduling and Resources; Quality and Professionalism.
Part B: Project implementation covering requirements elicitation, systems analysis and design modelling, database modelling, user interface design, coding and prototype development.
Practicals: Project work.
Assessment: 1.5 hour examination (30%), tests (20%), Group Project (50%)
DP Requirement: 40%

Applied Systems Implementation 2
ISTN3SI W2 P2   (30L-5T-20P-0S-82H-10R-0F-7G-16A-15W-16C)
Prerequisite Requirement: Systems analysis and design (ISTN211) and Database and programming (ISTN 212), and Introductory programming for information systems (with at least 40%) or an approved equivalent module
Aim: The purpose of the module is to equip students with knowledge and experience to facilitate the acquisition of expertise in the theoretical and practical use of current software development methodologies.
Content: Business Oriented Software System Development, Business Intelligence Reporting, Software Testing and Quality Assurance, Web based software development – HTML/DHTML/CSS/ Javascript/ XML, Server side programming, Website design modelling and Usability, Database driven Websites, Abstract Data Types Using Object Oriented Programming, Advanced Object Oriented Software Development Methodology
Practicals: Exercises on the above topics.
Assessment: 1.5 hour examination (30%), tests/assignments (30%), Group Project (40%).
DP Requirement: Students must obtain a class record mark of at least 40%.

Networking and Database Management
ISTN3ND W2 P2   (39L-10T-8P-8S-55H-15R-0F-0G-25A-15W-16C)
Prerequisite Requirement: Systems analysis and design (ISTN211) and Database and programming (ISTN 212), and Introductory programming for information systems (with at least 40%) or an approved equivalent module
Aim: To provide students with knowledge of the technical background of information systems in a web and enterprise environment. To enable students to design and manage databases in a business context. This module in part builds on ISTN212 and prepares students for advanced database and network management issues as well as further preparing them for their Major Project
Content: Part A - Topics include Internet, Web and Server Technologies, Fundamental Concepts of Data Communication, Design of Network Infrastructure, Infrastructure for Application Services, and Internet Security Solutions.
Part B- Topics include Database Design, Transaction Management and Concurrency Control, Distributed Database Management Systems, Data Warehouses, Databases and the Internet, and Database Administration.
Practicals: Exercises on the above topics.
Assessment: 3 hour examination (60%), tests/assignments (40%). Students must obtain at least 40% for the examination.
DP Requirement: Students must obtain a class record mark of at least 40%.

Law

Offered in the School of Law

Aspects of South African Law
LAWS1AS H2 P2   (19.5L-10T-0P-19.5S-111H-0R-0F-0G-0A-13W-16C)
Content: Aspects of South African Law will provide students with a background to some areas of South African Law. Students will acquire an understanding of: -The history of South African Law and the reasons for the current political and legal systems in South Africa. -The general scheme of the constitution, the Bill of Rights and the equality and property clauses in particular. -The basic principles of the Laws of Delict and Contract and Family Law and be able to apply these principles to factual scenarios.
Assessment: Class mark 50%, Examination 50%
DP Requirement: The DP requirements are listed on the module outline.

Introduction to Law
LAWS1IL H1 P1   (19.5L-10T-0P-19.5S-111H-0R-0F-0G-0A-13W-16C)
Content: Introduction to Law will provide students with a basic background to law and the legal system in South Africa. Students will acquire an understanding of: -Some legal philosophies and be able to apply these philosophies to current legal situations. -The structure of the legal system and be able to identify the correct tribunal and procedure. -The

sources and classifications of South African Law. -The basic principles of criminal law and be able to apply these principles to a factual scenario.
Assessment: Class mark: (50%), Examination: (50%).
DP Requirement: The DP requirements are listed on the module outline.

Property
LAWP2PR H2 P2   (39L-4.5T-0P-0S-71H-4R-1.5F-0G-4A-15W-16C)
Content: Basic concepts, definitions and sources of property law; Definition and classification of things; Real and personal rights; The changing nature of ownership; acquisition and protection of, and limits on, ownership; Limited real rights (possession and servitudes); Constitutional protection of property and legislative limits on ownership, including land reform and environmental law.
Assessment: tests/assignments (40%; 1x3 h exam (60%)
DP Requirement: The DP requirements are listed on the module outline.