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FACULTIES OF THE
UNIVERSITY OF PRETORIA

HUMANITIES
NATURAL AND AGRICULTURAL SCIENCES
LAW
THEOLOGY
ECONOMIC AND MANAGEMENT SCIENCES
VETERINARY SCIENCE
EDUCATION
HEALTH SCIENCES
ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY
PART I
(this publication)

SCHOOL OF ENGINEERING
• Chemical Engineering
• Civil Engineering
• Electrical, Electronic and Computer Engineering
• Industrial and Systems Engineering
• Mechanical and Aeronautical Engineering
• Materials Science and Metallurgical Engineering
• Mining Engineering

GRADUATE SCHOOL OF TECHNOLOGY MANAGEMENT
• Engineering and Technology Management

PART II
(separate publication)

SCHOOL FOR THE BUILT ENVIRONMENT
• Architecture and Landscape Architecture
• Construction Economics
• Town and Regional Planning

PART III
(separate publication)

SCHOOL OF INFORMATION TECHNOLOGY
• Informatics
• Information Science
• Computer Science
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Bachelor in Engineering
BEng programme (four years)
BEng augmented programme (ENGAGE) (five years)

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Programme Information
All fields of study of the BEng degree have been accredited by the Engineering Council of South Africa (ECSA), and comply with the academic requirements for registration as a professional engineer. The programmes are designed in accordance with the outcomes-based model as required by the South African Qualifications Authority (SAQA). The learning outcomes and contents of the programmes have been compiled in accordance with the latest accreditation standards (PE-60 and PE-61) of ECSA, which also comply with the SAQA requirements, and which are summarised as follows:

Learning outcomes of the BEng degree:
A graduate in engineering should be able to apply the following skills on an advanced level:

b. Application of specialist and fundamental knowledge, with specific reference to mathematics, basic sciences and engineering sciences.
c. Engineering design and synthesis.
d. Investigation, experimentation and data analysis.
e. Engineering methods, skills, tools and information technology.
f. Professional and general communication.
g. Awareness and knowledge of the impact of engineering activity on society and the physical environment.
h. Work in teams and in multidisciplinary environments.
i. An awareness and ability for lifelong learning.
j. An awareness and knowledge of principles of professional ethics and practice.

Learning contents of the BEng programmes:
Six essential knowledge areas are included in the syllabi of the programmes. The typical representation of each knowledge area as a percentage of the total contents of an undergraduate programme is given in brackets ( ) in the list below. This percentage varies for the different study directions, but conforms in all instances to the minimum knowledge area content as stipulated by ECSA.

Knowledge areas of the BEng programme
a. Mathematics, including numerical methods and statistics (13%)
b. Basic sciences: the natural sciences essential to the programme (15%)
c. Engineering sciences (40%)
d. Engineering design and synthesis (16%)
e. Computing and information technology (5%)
f. Complementary studies: communication, economy, management, innovation, environmental impact, ethics, engineering practice (11%).

Admission Requirements
• The following persons will be considered for admission: a candidate who is in possession of a certificate that is deemed by the University to be equivalent to the required Grade 12 certificate with university endorsement; a candidate who is a graduate from another tertiary institution or has been granted the status of a graduate of such an institution; and a candidate who is a graduate of another faculty at the University of Pretoria.
• Life Orientation is excluded when calculating the APS.
• Grade 11 results are used in the provisional admission of prospective students.
• A valid qualification with admission to degree studies is required.
• Minimum subject and achievement requirements, as set out below, are required. On first-year level a student has a choice between Afrikaans and English as language medium. In certain cases, tuition may be presented in English only, for example in electives, where the lecturer may not speak Afrikaans or in cases where it is not economically or practically viable.
• Provisional admission to the four-year programmes in the School of Engineering is only guaranteed if a prospective student complies with ALL the requirements below.
• Note: Candidates who do not comply with the minimum requirements, set out above, but who have obtained a minimum APS of 30, an achievement level of 5 for English or Afrikaans, 6 for Mathematics and 5 for Physical Science, will be considered for provisional admission to either the four-year programme or the ENGAGE programme based on the results of the NBT.

2
• Admission to ENGAGE in the School of Engineering will be determined by the results of the NBT, NSC results, an achievement level of 5 in Mathematics and 4 in Physical Science, as well as an achievement level of 4 in Afrikaans or English, together with an APS of 25.

• Students may apply directly to be considered for the ENGAGE programme.

Admission requirements for candidates with a National Senior Certificate (NSC)
To be able to gain access to the faculty and specific programmes prospective students require the appropriate combinations of recognised NSC subjects as well as certain levels of achievement in the said subjects. In this regard the determination of an admission point score (APS) is explained and a summary of the faculty specific requirements, i.e. the APS per programme and the specific subjects required per programme is provided.

Determination of an Admission Point Score (APS)
• The calculation is simple and based on a candidate’s achievement in six 20-credit recognised subjects by using the NSC ratings, that is the “1 to 7 scale of achievement”. Thus, the highest APS that can be achieved is 42.

• Life Orientation is excluded from the calculation determining the APS required for admission.

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Candidates who do not comply with the minimum requirements mentioned above, but who do comply with these requirements, must write the NBT. They may be admitted to the four-year degree or ENGAGE based on the NBT results.
Other programme-specific information

With a few exceptions, most modules offered at the School of Engineering are semester modules having credit values of either 8 or 16. A student may be permitted by the Dean, on recommendation of the relevant head of the department, to register for an equivalent module in an alternate semester, although the module is normally offered to the student’s group in another semester, and providing that no timetable clashes occur.

Please note:
1. Students who did not pass SWK 122 Mechanics 122 in their first year of study can take the module in the first semester of the following year.
2. All students are required to successfully complete JCP 2013, Community-based project 203 as part of the requirements for the BEng degree. A student may register for the module during any of the years of study of the programme, but preferably not during the first or the final year of study.
3. Students registered for Chemical Engineering who have passed CBI 311, receive credit for CBI 410.
4. Mechanical Engineering: For the Aeronautical Option, the themes of both the Design and the Project must be aeronautical-related.
5. Offering of electives depends on the availability of resources and industry support.

Promotion to next study year

Promotion to the second semester of the first year and to the second year of study (Eng. 14)

a. A new first-year student who has failed in all the prescribed modules of the programme at the end of the first semester, is excluded from studies in the School of Engineering. A student who is registered for the Engineering Augmented Degree Programme and has passed only 8 credits will also be excluded.

b. A student who complies with all the requirements of the first year of study, is promoted to the second year of study.

c. A student who has not passed at least 70% of the credits of the first year of study after the November examinations, must reapply for admission should he/she intend to proceed with his/her studies. Application on the prescribed form must be submitted to the Student Administration of the School of Engineering not later than 11 January. Late applications will be accepted only in exceptional circumstances after approval by the Dean. Should first-year students be readmitted, conditions of readmission will be determined by the Admissions Committee.

d. Students who have not passed all the prescribed modules at first year level (level 100), as well as students who are readmitted in terms of Faculty Regulations must register for the outstanding first-year level (level-100) modules.

e. A student who is repeating his or her first year, may, on recommendation of the relevant heads of department and with the approval of the Dean, be permitted to enroll for modules of the second-year of study in addition to the first-year modules which he or she failed, providing that he or she complies with the prerequisites for the second-year modules and no timetable clashes occur. Students on the ENGAGE programme may, following the same procedure, be permitted to enrol for level-200 modules in addition to the level-100 modules which he/she failed providing that he/she complies with the prerequisites for the modules at 200-level and no timetable clashes occur. On recommendation of the relevant head of department and with special permission from the Dean, permission may be granted to exceed the prescribed number of credits. The total number of credits which may be approved may not exceed the normal number of credits per semester by more than 16 credits.
f. Students in Computer, Electrical and Electronic Engineering, who fail a first-year module for the second time, forfeit the privilege of registering for any modules of an advanced year of study.

Please note:

i. From the second year of study each student should be in possession of an approved calculator. It is assumed that each student will have easy access to a personal computer.

ii. Students who intend transferring to Mining Engineering, must familiarise themselves with the stipulations set out in the syllabi of PWP 121 Workshop practice 121.

Promotion to the third year of study of the Four-year Programme, as well as to the third and the fourth years of study of the ENGAGE Programme. In case of the fourth year of study of the ENGAGE Programme, the words "first", "second" and "third" must be substituted with the words "second", "third" and "fourth" respectively. (Eng. 15)

a. A student who complies with all the requirements of the second year of study, is promoted to the third year of study.

b. A student must pass all the prescribed modules at first year level (level 100) before he or she is admitted to any module at third year level (level 300).

c. A student who is repeating his or her second year must register for all the second-year modules still outstanding. Such a student may, on recommendation of the relevant head of department and with the approval of the Dean, be permitted to enroll for modules of the third year of study in addition to the second-year modules which he or she failed, providing that he or she complies with the prerequisites for the third-year modules and no timetable clashes occur. On recommendation of the relevant head of department, and with special permission from the Dean, permission may be granted to exceed the prescribed number of credits. The total number of credits which may be approved may not exceed the normal number of credits per semester by more than 16 credits.

d. Students in Computer, Electrical and Electronic Engineering who fail a second-year module for the second time forfeit the privilege of registering for any modules of the third year of study.

e. Students who intend transferring to Mining Engineering must familiarise themselves with the stipulations set out in the syllabi of PWP 120 Workshop practice 120, as well as PPY 317 Practical training 317.

Promotion to the fourth year of study of the Four-year Programme, as well as to the fifth year of study of the ENGAGE Programme. In case of the fifth year of study of the ENGAGE Programme, the words "second", "third" and "fourth" must be substituted with the words "third", "fourth" and "fifth" respectively. (Eng. 16)

a. A student who complies with all the requirements of the third year of study is promoted to the fourth year of study. A student who does not comply with all the requirements but who is able to register for all outstanding modules in order to complete the degree programme, may at registration be promoted to the fourth year of study.

b. A student must pass all the prescribed modules of the second year of study, before he or she is admitted to any module of the fourth year of study.

c. A student who has not passed all the prescribed modules of the third year of study, must register for the outstanding modules. A student may be admitted by the Dean, on the recommendation of the head of department concerned, to modules of the fourth year of study, in addition to the outstanding third-year modules, provided that
he or she complies with the prerequisites of the fourth-year modules and no timetable clashes occur. The total number of credits per semester for which a student registers may not exceed the normal number of credits per semester by more than 16 credits. In exceptional cases, the Dean may, on recommendation of the relevant head of department, permit a student to exceed the above limit.

d. Students in Computer, Electrical and Electronic Engineering who fail a third-year module for the second time, forfeit the privilege of registering for any modules of the fourth year of study.

Pass with Distinction

a. A student graduates with distinction if:
   i. no module of the third or fourth year of study of the four year programme or of the fourth or fifth year of the ENGAGE programme was repeated and a weighted average of at least 75% was obtained in one year in all the modules of the final year of study; and
   ii. the degree programme was completed within the prescribed four years for the four year programme and within the prescribed five years of the ENGAGE programme.

b. Exceptional cases to the above will be considered by the Dean.
Curricula for the Four year programmes and Five year ENGAGE programmes

1.1 BEng Chemical Engineering
12130002
Duration of study: 4 years

Curriculum: Year 1
Minimum Credits: 160

Semester one
Fundamental
UPO 112 Academic orientation 112 - Credits: 0.00

Core
CHM 171 General chemistry 171 - Credits: 16.00
CIR 113 Chemical engineering 113 - Credits: 8.00
FSK 116 Physics 116 - Credits: 16.00
HAS 110 Humanities and social sciences 110 - Credits: 8.00
MGC 110 Graphical communication 110 - Credits: 16.00
WTW 158 Calculus 158 - Credits: 16.00

Semester two
Core
CHM 181 General chemistry 181 - Credits: 16.00
CIR 123 Chemical engineering 123 - Credits: 8.00
EBN 122 Electricity and electronics 122 - Credits: 16.00
HAS 120 Humanities and social sciences 120 - Credits: 8.00
SWK 122 Mechanics 122 - Credits: 16.00
WTW 164 Mathematics 164 - Credits: 16.00

Recess training
WWP 121 Workshop practice 121 - Credits: 6.00

Curriculum: Year 2
Minimum Credits: 162

Semester one
Core
CHM 215 Chemistry 215 - Credits: 12.00
CIR 211 Chemical engineering 211 - Credits: 12.00
CIM 210 Chemical engineering materials 210 - Credits: 8.00
JCP 203 Community-based project 203 - Credits: 8.00
MPR 213 Programming and information technology 213 - Credits: 16.00
SWK 210 Strength of materials 210 - Credits: 16.00
WTW 256 Differential equations 256 - Credits: 8.00
WTW 258 Calculus 258 - Credits: 8.00

Semester two
Core
BES 220 Engineering statistics 220 - Credits: 8.00
CHM 226 Chemistry 226 - Credits: 8.00
CTD 223 Thermodynamics 223 - Credits: 16.00
EIR 221 Electrical engineering 221 - Credits: 16.00
WTW 238 Mathematics 238 - Credits: 16.00
WTW 263 Numerical methods 263 - Credits: 8.00
Curriculum: Year 3
Minimum Credits: 144
Semester one
Core
BSS 310  Engineering management 310 - Credits: 8.00
CIR 310  Chemical engineering 310 - Credits: 8.00
CJJ 310  Professional and technical communication 310 - Credits: 8.00
CMO 310  Mass transfer 310 - Credits: 16.00
COP 311  Transfer processes 311 - Credits: 16.00
CBI 310  Biochemical engineering 310 - Credits: 16.00
Semester two
Core
CIO 320  Chemical engineering design 320 - Credits: 16.00
CKN 321  Kinetics 321 - Credits: 16.00
CLB 321  Laboratory 321 - Credits: 16.00
CPN 321  Process dynamics 321 - Credits: 16.00
MIA 320  Engineering activity and group work 320 - Credits: 8.00
Recess training
CPY 311  Practical training 311 - Credits: 16.00

Curriculum: Final Year
Minimum Credits: 144
Semester one
Core
CPA 410  Particle technology 410 - Credits: 16.00
CPB 410  Process control 410 - Credits: 16.00
CPS 410  Process synthesis 410 - Credits: 8.00
CRO 410  Reactor design 410 - Credits: 16.00
CSC 411  Research project 411 - Credits: 16.00
Semester two
Core
CPJ 421  Design project 421 - Credits: 24.00
CPR 420  Chemical engineering practice 420 - Credits: 8.00
CP 420  Process analysis 420 - Credits: 8.00
CSC 421  Research project 421 - Credits: 16.00
CSS 420  Specialisation 420 - Credits: 16.00
Recess training
CPY 411  Practical training 411 - Credits: 16.00

1.2  BEng Chemical Engineering Engage  
12136002  
Duration of study: 5 years

Curriculum: Year 1
Minimum Credits: 128
Semester one
Fundamental
UPO 112  Academic orientation 112 - Credits: 0.00
Core
CHM 171  General chemistry 171 - Credits: 16.00
HAS 110  Humanities and social sciences 110 - Credits: 8.00
Engineering 2017

JPO 110  Professional orientation 110 - Credits: 8.00
JPO 111  Additional Chemistry 1 111 - Credits: 8.00
JPO 116  Additional Mathematics 1 116 - Credits: 8.00
WTW 158  Calculus 158 - Credits: 16.00

Semester two

Core
FSK 176  Physics 176 - Credits: 16.00
HAS 120  Humanities and social sciences 120 - Credits: 8.00
JPO 120  Professional orientation 120 - Credits: 8.00
JPO 122  Additional Physics 122 - Credits: 8.00
JPO 126  Additional Mathematics 1 126 - Credits: 8.00
WTW 164  Mathematics 164 - Credits: 16.00

Recess training
WWP 121  Workshop practice 121 - Credits: 6.00

Curriculum: Year 2
Minimum Credits: 136

Semester one

Core
CIR 113  Chemical engineering 113 - Credits: 8.00
EBN 111  Electricity and electronics 111 - Credits: 16.00
JCP 203  Community-based project 203 - Credits: 8.00
JPO 112  Additional Electricity and electronics 112 - Credits: 8.00
JPO 113  Additional Graphical communication 113 - Credits: 8.00
MGC 110  Graphical communication 110 - Credits: 16.00
WTW 258  Calculus 258 - Credits: 8.00

Semester two

Core
CHM 181  General chemistry 181 - Credits: 16.00
CIR 123  Chemical engineering 123 - Credits: 8.00
JPO 121  Additional Chemistry 2 121 - Credits: 8.00
SWK 122  Mechanics 122 - Credits: 16.00
WTW 263  Numerical methods 263 - Credits: 8.00
JPO 125  Additional Mechanics 125 - Credits: 8.00

Curriculum: Year 3
Minimum Credits: 138

Semester one

Core
CHM 215  Chemistry 215 - Credits: 12.00
CIR 211  Chemical engineering 211 - Credits: 12.00
CIM 210  Chemical engineering materials 210 - Credits: 8.00
MPR 213  Programming and information technology 213 - Credits: 16.00
SWK 210  Strength of materials 210 - Credits: 16.00
WTW 256  Differential equations 256 - Credits: 8.00

Semester two

Core
BES 220  Engineering statistics 220 - Credits: 8.00
CHM 226  Chemistry 226 - Credits: 8.00
CTD 223  Thermodynamics 223 - Credits: 16.00
EIR 221  Electrical engineering 221 - Credits: 16.00
WTW 238  Mathematics 238 - Credits: 16.00
### Curriculum: Year 4

**Minimum Credits: 144**

#### Semester one

**Core**
- **BSS 310** Engineering management 310 - Credits: 8.00
- **CIR 310** Chemical engineering 310 - Credits: 8.00
- **CJJ 310** Professional and technical communication 310 - Credits: 8.00
- **CMO 310** Mass transfer 310 - Credits: 16.00
- **COP 311** Transfer processes 311 - Credits: 16.00
- **CBI 310** Biochemical engineering 310 - Credits: 16.00

#### Semester two

**Core**
- **CIO 320** Chemical engineering design 320 - Credits: 16.00
- **CKN 321** Kinetics 321 - Credits: 16.00
- **CLB 321** Laboratory 321 - Credits: 16.00
- **CPN 321** Process dynamics 321 - Credits: 16.00
- **MIA 320** Engineering activity and group work 320 - Credits: 8.00

**Recess training**
- **CPY 311** Practical training 311 - Credits: 16.00

### Curriculum: Final Year

**Minimum Credits: 144**

#### Semester one

**Core**
- **CPA 410** Particle technology 410 - Credits: 16.00
- **CPB 410** Process control 410 - Credits: 16.00
- **CPS 410** Process synthesis 410 - Credits: 8.00
- **CRO 410** Reactor design 410 - Credits: 16.00
- **CSC 411** Research project 411 - Credits: 16.00

#### Semester two

**Core**
- **CPJ 421** Design project 421 - Credits: 24.00
- **CPR 420** Chemical engineering practice 420 - Credits: 8.00
- **CPS 420** Process analysis 420 - Credits: 8.00
- **CSC 421** Research project 421 - Credits: 16.00
- **CSS 420** Specialisation 420 - Credits: 16.00

**Recess training**
- **CPY 411** Practical training 411 - Credits: 16.00

### 1.3 BEng Civil Engineering

**12130007**

Duration of study: 4 years

#### Curriculum: Year 1

**Minimum Credits: 144**

#### Semester one

**Fundamental**
- **UPO 112** Academic orientation 112 - Credits: 0.00

**Core**
- **CHM 171** General chemistry 171 - Credits: 16.00
- **HAS 110** Humanities and social sciences 110 - Credits: 8.00
MGC 110  Graphical communication 110 - Credits: 16.00  
NMC 113  Materials science 113 - Credits: 16.00  
WTW 158  Calculus 158 - Credits: 16.00  
**Semester two**  
**Core**  
EBN 122  Electricity and electronics 122 - Credits: 16.00  
FSK 176  Physics 176 - Credits: 16.00  
HAS 120  Humanities and social sciences 120 - Credits: 8.00  
SWK 122  Mechanics 122 - Credits: 16.00  
SWP 121  Workshop practice 121 - Credits: 6.00  
**Recess training**  
WTW 164  Mathematics 164 - Credits: 16.00  

**Curriculum: Year 2**  
**Minimum Credits: 152**  

**Semester one**  
**Core**  
JCP 203  Community-based project 203 - Credits: 8.00  
SGM 210  Geomaterials and processes 210 - Credits: 16.00  
SJJ 210  Professional and technical communication 210 - Credits: 8.00  
SWK 210  Strength of materials 210 - Credits: 16.00  
SWK 211  Statics 211 - Credits: 16.00  
WTW 256  Differential equations 256 - Credits: 8.00  
WTW 258  Calculus 258 - Credits: 8.00  

**Semester two**  
**Core**  
BES 220  Engineering statistics 220 - Credits: 8.00  
SBZ 221  Civil engineering measurement techniques 221 - Credits: 8.00  
SGM 221  Pavement materials and design 221 - Credits: 16.00  
SIN 223  Structural analysis 223 - Credits: 16.00  
WTW 238  Mathematics 238 - Credits: 16.00  
WTW 263  Numerical methods 263 - Credits: 8.00  

**Curriculum: Year 3**  
**Minimum Credits: 154**  

**Semester one**  
**Core**  
MPR 213  Programming and information technology 213 - Credits: 16.00  
SGM 311  Soil mechanics 311 - Credits: 16.00  
SHC 310  Hydraulics 310 - Credits: 16.00  
SIB 310  Timber design 310 - Credits: 8.00  
SIE 310  Civil engineering economics 310 - Credits: 8.00  
SIN 311  Structural analysis 311 - Credits: 8.00  

**Semester two**  
**Core**  
SBM 321  Civil building materials 321 - Credits: 16.00  
SGM 323  Geotechnical engineering 323 - Credits: 16.00  
SHC 321  Hydraulics 321 - Credits: 16.00  
SIN 325  Structural concrete 325 - Credits: 16.00  
SVC 323  Transportation engineering 323 - Credits: 16.00
Curriculum: Final Year
Minimum Credits: 158

Semester one
Core
IPI 410 Engineering professionalism 410 - Credits: 8.00
SHC 410 Hydraulics 410 - Credits: 16.00
SSC 412 Research project 412 - Credits: 30.00
SVC 412 Infrastructure planning 412 - Credits: 16.00
SIN 415 Structural steel 415 - Credits: 16.00

Semester two
Core
SBZ 420 Civil engineering construction management 420 - Credits: 16.00
SCA 420 Computer applications in civil engineering 420 - Credits: 16.00
SDO 420 Detailed design 420 - Credits: 24.00
SEV 421 Environmental geotechnology 421 - Credits: 16.00

Recess training
SPY 410 Practical training 410 - Credits: 16.00

1.4 BEng Civil Engineering Engage
12136007
Duration of study: 5 years

Curriculum: Year 1
Minimum Credits: 128

Semester one
Fundamental
UPO 112 Academic orientation 112 - Credits: 0.00
Core
CHM 171 General chemistry 171 - Credits: 16.00
HAS 110 Humanities and social sciences 110 - Credits: 8.00
JPO 110 Professional orientation 110 - Credits: 8.00
JPO 111 Additional Chemistry 1 111 - Credits: 8.00
JPO 116 Additional Mathematics 1 116 - Credits: 8.00
WTW 158 Calculus 158 - Credits: 16.00

Semester two
Core
FSK 176 Physics 176 - Credits: 16.00
HAS 120 Humanities and social sciences 120 - Credits: 8.00
JPO 120 Professional orientation 120 - Credits: 8.00
JPO 122 Additional Physics 122 - Credits: 8.00
JPO 126 Additional Mathematics 2 126 - Credits: 8.00
WTW 164 Mathematics 164 - Credits: 16.00

Recess training
SWP 121 Workshop practice 121 - Credits: 6.00

Curriculum: Year 2
Minimum Credits: 120

Semester one
Core
EBN 111 Electricity and electronics 111 - Credits: 16.00
JCP 203 Community-based project 203 - Credits: 8.00
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**Curriculum: Year 3**

**Minimum Credits: 128**

**Semester one**

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<td>SGM 221</td>
<td>Pavement materials and design 221</td>
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<td>SIN 223</td>
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**Curriculum: Year 4**

**Minimum Credits: 154**

**Semester one**

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**Curriculum: Final Year**

**Minimum Credits: 158**

**Semester one**

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**Semester two**

**Core**

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<td>SPY 410</td>
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**1.5 BEng Computer Engineering**

12130009

Duration of study: 4 years

**Curriculum: Year 1**

**Minimum Credits: 144**

Please Note: Cos 222 has been replaced by Cos122 as from 2017 academic year. Students who have already passed Cos 222 will be credited for Cos 122.

**Semester one**

**Fundamental**

<table>
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<tr>
<th>Course Code</th>
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**Core**

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**Semester two**

**Core**

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<td>Operating systems 122</td>
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**Recess training**

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<td>EMR 101</td>
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**Curriculum: Year 2**

**Minimum Credits: 144**

**Semester one**

**Core**

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<td>EJJ 210</td>
<td>Professional and technical communication 210</td>
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JCP 203  Community-based project 203 - Credits: 8.00
NMC 113  Materials science 113 - Credits: 16.00
WTW 256  Differential equations 256 - Credits: 8.00
WTW 258  Calculus 258 - Credits: 8.00

Semester two
Core
BES 220  Engineering statistics 220 - Credits: 8.00
ELI 220  Linear systems 220 - Credits: 16.00
ERS 220  Digital systems 220 - Credits: 16.00
WTW 238  Mathematics 238 - Credits: 16.00
WTW 263  Numerical methods 263 - Credits: 8.00

Recess training
EIW 221  Information technology practice 221 - Credits: 8.00

Curriculum: Year 3
Minimum Credits: 144
Semester on
Core
BSS 310  Engineering management 310 - Credits: 8.00
EAI 320  Intelligent systems 320 - Credits: 16.00
EME 310  Electromagnetic compatibility 310 - Credits: 16.00
EMK 310  Microprocessors 310 - Credits: 16.00
ENE 310  Analogue electronics 310 - Credits: 16.00

Semester two
Core
EBB 320  Control systems 320 - Credits: 16.00
EDC 310  Digital communication 310 - Credits: 16.00
EPE 321  Software engineering 321 - Credits: 16.00
ERD 320  Computer engineering design 320 - Credits: 16.00
MIA 320  Engineering activity and group work 320 - Credits: 8.00

Recess training
EIW 320  Information technology practice 320 - Credits: 8.00

Curriculum: Final Year
Minimum Credits: 136
Semester one
Core
EAS 410  Computer engineering: Architecture and systems 410 - Credits: 16.00
EHN 410  e-Business and network security 410 - Credits: 16.00
EPR 402  Project 402 - Credits: 16.00
ESP 411  DSP programming and application 411 - Credits: 16.00
IPI 410  Engineering professionalism 410 - Credits: 8.00

Semester two
Core
EPR 402  Project 402 - Credits: 48.00
ERP 420  Specialisation 420 - Credits: 16.00

Recess training
EPY 423  Practical training and report 423 - Credits: 16.00
1.6 BEng Computer Engineering Engage

12136009
Duration of study: 5 years

Please Note: Cos 222 has been replaced by Cos122 as from 2017 academic year. Students who have already passed Cos 222 will be credited for Cos 122.

**Minimum Credits: 128**

**Curriculum: Year 1**

**Semester one**

**Fundamental**

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<td>JPO 110</td>
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<td>JPO 116</td>
<td>Additional Mathematics 1 116 - Credits: 8.00</td>
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<td>JPO 152</td>
<td>Additional Physics 152 - Credits: 8.00</td>
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**Semester two**

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**Curriculum: Year 2**

**Minimum Credits: 112**

**Semester one**

**Core**

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<td>JPO 112</td>
<td>Additional Electricity and electronics 112 - Credits: 8.00</td>
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<td>JPO 114</td>
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**Recess training**

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<td>EIW 221</td>
<td>Information technology practice 221 - Credits: 8.00</td>
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<tr>
<td>EMR 101</td>
<td>Introduction to laboratory measurements and computer simulations 101 - Credits: 4.00</td>
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Curriculum: Year 3
Minimum Credits: 128

Semester one
Core
COS 212 Data structures and algorithms 212 - Credits: 16.00
EIR 211 Electrical engineering 211 - Credits: 16.00
EJJ 210 Professional and technical communication 210 - Credits: 8.00
JCP 203 Community-based project 203 - Credits: 8.00
WTW 256 Differential equations 256 - Credits: 8.00

Semester two
Core
BES 220 Engineering statistics 220 - Credits: 8.00
ELI 220 Linear systems 220 - Credits: 16.00
ERS 220 Digital systems 220 - Credits: 16.00
WTW 238 Mathematics 238 - Credits: 16.00

Recess training
EIW 320 Information technology practice 320 - Credits: 8.00

Curriculum: Year 4
Minimum Credits: 144

Semester one
Core
BSS 310 Engineering management 310 - Credits: 8.00
EAI 320 Intelligent systems 320 - Credits: 16.00
EME 310 Electromagnetic compatibility 310 - Credits: 16.00
EMK 310 Microprocessors 310 - Credits: 16.00
ENE 310 Analogue electronics 310 - Credits: 16.00

Semester two
Core
EBB 320 Control systems 320 - Credits: 16.00
EDC 310 Digital communication 310 - Credits: 16.00
EPE 321 Software engineering 321 - Credits: 16.00
ERD 320 Computer engineering design 320 - Credits: 16.00
MIA 320 Engineering activity and group work 320 - Credits: 8.00

Recess training
EIW 320 Information technology practice 320 - Credits: 8.00

Curriculum: Final Year
Minimum Credits: 136

Semester one
Core
EAS 410 Computer engineering: Architecture and systems 410 - Credits: 16.00
EHN 410 e-Business and network security 410 - Credits: 16.00
EPR 402 Project 402 - Credits: 16.00
ESP 411 DSP programming and application 411 - Credits: 16.00
IPI 410 Engineering professionalism 410 - Credits: 8.00

Semester two
Core
EPR 402 Project 402 - Credits: 48.00
ERP 420 Specialisation 420 - Credits: 16.00

Recess training
EPY 423 Practical training and report 423 - Credits: 16.00
1.7 BEng Electrical Engineering

12130003
Duration of study: 4 years

Curriculum: Year 1
Minimum Credits: 144

Fundamental
UPO 112  Academic orientation 112 - Credits: 0.00

Core
CHM 171  General chemistry 171 - Credits: 16.00
HAS 110  Humanities and social sciences 110 - Credits: 8.00
MGC 110  Graphical communication 110 - Credits: 16.00
NMC 113  Materials science 113 - Credits: 16.00
WTW 158  Calculus 158 - Credits: 16.00

Semester two

Core
EBN 122  Electricity and electronics 122 - Credits: 16.00
FSK 176  Physics 176 - Credits: 16.00
HAS 120  Humanities and social sciences 120 - Credits: 8.00
SWK 122  Mechanics 122 - Credits: 16.00
WTW 164  Mathematics 164 - Credits: 16.00

Recess training
EMR 101  Introduction to laboratory measurements and computer simulations 101 - Credits: 4.00

Curriculum: Year 2
Minimum Credits: 124

Semester one

Core
COS 132  Imperative programming 132 - Credits: 16.00
EIR 211  Electrical engineering 211 - Credits: 16.00
EJJ 210  Professional and technical communication 210 - Credits: 8.00
JCP 203  Community-based project 203 - Credits: 8.00
MSD 210  Dynamics 210 - Credits: 16.00
WTW 256  Differential equations 256 - Credits: 8.00
WTW 258  Calculus 258 - Credits: 8.00

Semester two

Core
BES 220  Engineering statistics 220 - Credits: 8.00
ELI 220  Linear systems 220 - Credits: 16.00
ERS 220  Digital systems 220 - Credits: 16.00
WTW 238  Mathematics 238 - Credits: 16.00
WTW 263  Numerical methods 263 - Credits: 8.00

Recess training
EPW 200  Practical wiring 200 - Credits: 4.00

Curriculum: Year 3
Minimum Credits: 144

Semester one

Core
BSS 310  Engineering management 310 - Credits: 8.00
ELX 311  Electrical machines 311 - Credits: 16.00
EMK 310 Microprocessors 310 - Credits: 16.00
EMZ 310 Electromagnetism 310 - Credits: 16.00
ENE 310 Analogue electronics 310 - Credits: 16.00

**Semester two**

**Core**
EBB 320 Control systems 320 - Credits: 16.00
EDF 320 Power electronics 320 - Credits: 16.00
EKK 320 Power system components 320 - Credits: 16.00
EWE 320 Electrical engineering design 320 - Credits: 16.00
MIA 320 Engineering activity and group work 320 - Credits: 8.00

**Recess training**
ESP 300 DSP programming 300 - Credits: 4.00

**Curriculum: Final Year**

**Minimum Credits: 136**

**Semester one**

**Core**
EAD 410 Electrical drives 410 - Credits: 16.00
EBT 410 Automation 410 - Credits: 16.00
EKK 410 Power system analysis 410 - Credits: 16.00
EPR 400 Project 400 - Credits: 16.00
IPI 410 Engineering professionalism 410 - Credits: 8.00

**Second semester**

**Core**
ENR 420 Energy systems 420 - Credits: 16.00
EPR 400 Project 400 - Credits: 48.00

**Recess training**
EPY 423 Practical training and report 423 - Credits: 16.00

1.8 **BEng Electrical Engineering Engage**

12136003

Duration of study: 5 years

**Curriculum: Year 1**

**Minimum Credits: 128**

**Semester one**

**Fundamental**
UPO 112 Academic orientation 112 - Credits: 0.00

**Core**
FSK 116 Physics 116 - Credits: 16.00
HAS 110 Humanities and social sciences 110 - Credits: 8.00
JPO 110 Professional orientation 110 - Credits: 8.00
JPO 116 Additional Mathematics 1 116 - Credits: 8.00
JPO 152 Additional Physics 152 - Credits: 8.00
WTW 158 Calculus 158 - Credits: 16.00

**Semester two**

**Core**
CHM 172 General chemistry 172 - Credits: 16.00
HAS 120 Humanities and social sciences 120 - Credits: 8.00
JPO 120 Professional orientation 120 - Credits: 8.00
JPO 126 Additional Mathematics 2 126 - Credits: 8.00
JPO 161  Additional Chemistry 1 161 - Credits: 8.00
WTW 164  Mathematics 164 - Credits: 16.00

**Curriculum: Year 2**
**Minimum Credits: 120**

**Semester one**

**Core**
- EBN 111  Electricity and electronics 111 - Credits: 16.00
- JCP 203  Community-based project 203 - Credits: 8.00
- JPO 112  Additional Electricity and electronics 112 - Credits: 8.00
- JPO 113  Additional Graphical communication 113 - Credits: 8.00
- MGC 110  Graphical communication 110 - Credits: 16.00
- WTW 258  Calculus 258 - Credits: 8.00

**Semester two**

**Core**
- JPO 123  Additional Materials science 123 - Credits: 8.00
- JPO 125  Additional Mechanics 125 - Credits: 8.00
- NMC 123  Materials science 123 - Credits: 16.00
- SWK 122  Mechanics 122 - Credits: 16.00
- WTW 263  Numerical methods 263 - Credits: 8.00

**Recess training**
- EMR 101  Introduction to laboratory measurements and computer simulations 101 - Credits: 4.00
- EPW 200  Practical wiring 200 - Credits: 4.00

**Curriculum: Year 3**
**Minimum Credits: 120**

**Semester one**

**Core**
- COS 132  Imperative programming 132 - Credits: 16.00
- EIR 211  Electrical engineering 211 - Credits: 16.00
- EJJ 210  Professional and technical communication 210 - Credits: 8.00
- MSD 210  Dynamics 210 - Credits: 16.00
- WTW 256  Differential equations 256 - Credits: 8.00

**Semester two**

**Core**
- BES 220  Engineering statistics 220 - Credits: 8.00
- ELI 220  Linear systems 220 - Credits: 16.00
- ERS 220  Digital systems 220 - Credits: 16.00
- WTW 238  Mathematics 238 - Credits: 16.00

**Curriculum: Year 4**
**Minimum Credits: 144**

**Semester one**

**Core**
- BSS 310  Engineering management 310 - Credits: 8.00
- ELX 311  Electrical machines 311 - Credits: 16.00
- EMK 310  Microprocessors 310 - Credits: 16.00
- EMZ 310  Electromagnetism 310 - Credits: 16.00
- ENE 310  Analogue electronics 310 - Credits: 16.00
Semester two

Core
EBB 320  Control systems 320 - Credits: 16.00
EDF 320  Power electronics 320 - Credits: 16.00
EKK 320  Power system components 320 - Credits: 16.00
EWE 320  Electrical engineering design 320 - Credits: 16.00
MIA 320  Engineering activity and group work 320 - Credits: 8.00

Recess training
ESP 300  DSP programming 300 - Credits: 4.00

Curriculum: Final Year
Minimum Credits: 136

Semester one

Core
EAD 410  Electrical drives 410 - Credits: 16.00
EBT 410  Automation 410 - Credits: 16.00
EKK 410  Power system analysis 410 - Credits: 16.00
EPR 400  Project 400 - Credits: 16.00
IPI 410  Engineering professionalism 410 - Credits: 8.00

Second semester

Core
ENR 420  Energy systems 420 - Credits: 16.00
EPR 400  Project 400 - Credits: 48.00

Recess training
EPY 423  Practical training and report 423 - Credits: 16.00

1.9  BEng Electronic Engineering
12130008
Duration of study: 4 years

Curriculum: Year 1
Minimum Credits: 144

Semester one

Fundamental
UPO 112  Academic orientation 112 - Credits: 0.00

Core
CHM 171  General chemistry 171 - Credits: 16.00
HAS 110  Humanities and social sciences 110 - Credits: 8.00
MGC 110  Graphical communication 110 - Credits: 16.00
NMC 113  Materials science 113 - Credits: 16.00
WTW 158  Calculus 158 - Credits: 16.00

Semester two

Core
EBN 122  Electricity and electronics 122 - Credits: 16.00
FSK 176  Physics 176 - Credits: 16.00
HAS 120  Humanities and social sciences 120 - Credits: 8.00
SWK 122  Mechanics 122 - Credits: 16.00
WTW 164  Mathematics 164 - Credits: 16.00

Recess training
EMR 101  Introduction to laboratory measurements and computer simulations 101 - Credits: 4.00
Curriculum: Year 2
Minimum Credits: 144

Semester one
Core
COS 132  Imperative programming 132 - Credits: 16.00
EIR 211  Electrical engineering 211 - Credits: 16.00
EJJ 210  Professional and technical communication 210 - Credits: 8.00
JCP 203  Community-based project 203 - Credits: 8.00
MSD 210  Dynamics 210 - Credits: 16.00
WTW 256  Differential equations 256 - Credits: 8.00
WTW 258  Calculus 258 - Credits: 8.00

Semester two
Core
BES 220  Engineering statistics 220 - Credits: 8.00
ELI 220  Linear systems 220 - Credits: 16.00
ERS 220  Digital systems 220 - Credits: 16.00
WTW 238  Mathematics 238 - Credits: 16.00
WTW 263  Numerical methods 263 - Credits: 8.00

Curriculum: Year 3
Minimum Credits: 144

Semester one
Core
BSS 310  Engineering management 310 - Credits: 8.00
EMK 310  Microprocessors 310 - Credits: 16.00
EMS 310  Modulation systems 310 - Credits: 16.00
EMZ 310  Electromagnetism 310 - Credits: 16.00
ENE 310  Analogue electronics 310 - Credits: 16.00

Semester two
Core
EBB 320  Control systems 320 - Credits: 16.00
ELO 320  Electronic engineering design 320 - Credits: 16.00
EMZ 320  Microwaves and antennas 320 - Credits: 16.00
ESC 320  Stochastic communications systems 320 - Credits: 16.00
MIA 320  Engineering activity and group work 320 - Credits: 8.00

Curriculum: Final Year
Minimum Credits: 136

Semester one
Core
EBT 410  Automation 410 - Credits: 16.00
ENE 410  Advanced electronics 410 - Credits: 16.00
EPR 400  Project 400 - Credits: 16.00
ESP 411  DSP programming and application 411 - Credits: 16.00
IPI 410  Engineering professionalism 410 - Credits: 8.00

Semester two
Core
EES 424  Specialisation 424 - Credits: 16.00
EPR 400  Project 400 - Credits: 48.00

Recess training
EPY 423  Practical training and report 423 - Credits: 16.00
1.10 BEng Electronic Engineering Engage
12136008
Duration of study: 5 years

Curriculum: Year 1
Minimum Credits: 128
Semester one
Fundamental
UPO 112 Academic orientation 112 - Credits: 0.00
Core
FSK 116 Physics 116 - Credits: 16.00
HAS 110 Humanities and social sciences 110 - Credits: 8.00
JPO 110 Professional orientation 110 - Credits: 8.00
JPO 116 Additional Mathematics 1116 - Credits: 8.00
JPO 152 Additional Physics 152 - Credits: 8.00
WTW 158 Calculus 158 - Credits: 16.00

Semester two
Core
CHM 172 General chemistry 172 - Credits: 16.00
HAS 120 Humanities and social sciences 120 - Credits: 8.00
JPO 120 Professional orientation 120 - Credits: 8.00
JPO 126 Additional Mathematics 2126 - Credits: 8.00
JPO 161 Additional Chemistry 1161 - Credits: 8.00
WTW 164 Mathematics 164 - Credits: 16.00

Curriculum: Year 2
Minimum Credits: 120
Semester one
Core
EBN 111 Electricity and electronics 111 - Credits: 16.00
JCP 203 Community-based project 203 - Credits: 8.00
JPO 112 Additional Electricity and electronics 112 - Credits: 8.00
JPO 113 Additional Graphical communication 113 - Credits: 8.00
MGC 110 Graphical communication 110 - Credits: 16.00
WTW 258 Calculus 258 - Credits: 8.00

Semester two
Core
JPO 123 Additional Materials science 123 - Credits: 8.00
JPO 125 Additional Mechanics 125 - Credits: 8.00
NMC 123 Materials science 123 - Credits: 16.00
SWK 122 Mechanics 122 - Credits: 16.00
WTW 263 Numerical methods 263 - Credits: 8.00
Recess training
EMR 101 Introduction to laboratory measurements and computer simulations 101 - Credits: 4.00

Curriculum: Year 3
Minimum Credits: 120
Semester one
Core
COS 132 Imperative programming 132 - Credits: 16.00
EIR 211 Electrical engineering 211 - Credits: 16.00
EJJ 210  Professional and technical communication 210 - Credits: 8.00
MSD 210  Dynamics 210 - Credits: 16.00
WTW 256  Differential equations 256 - Credits: 8.00

Semester two
Core
BES 220  Engineering statistics 220 - Credits: 8.00
ELI 220  Linear systems 220 - Credits: 16.00
ERS 220  Digital systems 220 - Credits: 16.00
WTW 238  Mathematics 238 - Credits: 16.00

Curriculum: Year 4
Minimum Credits: 144

Semester one
Core
BSS 310  Engineering management 310 - Credits: 8.00
EMK 310  Microprocessors 310 - Credits: 16.00
EMS 310  Modulation systems 310 - Credits: 16.00
EMZ 310  Electromagnetism 310 - Credits: 16.00
ENE 310  Analogue electronics 310 - Credits: 16.00

Semester two
Core
EBB 320  Control systems 320 - Credits: 16.00
ELO 320  Electronic engineering design 320 - Credits: 16.00
EMZ 320  Microwaves and antennas 320 - Credits: 16.00
ESC 320  Stochastic communications systems 320 - Credits: 16.00
MIA 320  Engineering activity and group work 320 - Credits: 8.00

Curriculum: Final Year
Minimum Credits: 136

Semester one
Core
EBT 410  Automation 410 - Credits: 16.00
ENE 410  Advanced electronics 410 - Credits: 16.00
EPR 400  Project 400 - Credits: 16.00
ESP 411  DSP programming and application 411 - Credits: 16.00
IPI 410  Engineering professionalism 410 - Credits: 8.00

Semester two
Core
EES 424  Specialisation 424 - Credits: 16.00
EPR 400  Project 400 - Credits: 48.00

Recess training
EPY 423  Practical training and report 423 - Credits: 16.00

1.11  BEng Industrial Engineering
12130001
Duration of study: 4 years

Curriculum: Year 1
Minimum Credits: 144
Semester one

Fundamental
UPO 112  Academic orientation 112 - Credits: 0.00
### Core

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### Semester two

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### Curriculum: Year 2

**Minimum Credits: 146**

### Semester one

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<td>MPR 213</td>
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### Curriculum: Year 3

**Minimum Credits: 154**

### Semester one

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### Semester two

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<td>BID 320</td>
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<td>BLK 320</td>
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<td>BUY 321</td>
<td>Simulation modelling 321</td>
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### Curriculum: Final Year

**Minimum Credits: 144**

#### Semester one

**Core**
- **BGC 410** Quality assurance 410 - Credits: 16.00
- **BON 410** Operational research 410 - Credits: 16.00
- **BPJ 410** Project 410 - Credits: 16.00
- **BSR 410** Management accounting 410 - Credits: 16.00
- **IPI 410** Engineering professionalism 410 - Credits: 8.00

#### Semester two

**Core**
- **ABV 320** Labour relations 320 - Credits: 20.00
- **BIE 420** Engineering economics 420 - Credits: 8.00
- **BPJ 420** Project 420 - Credits: 24.00
- **BPZ 421** Business engineering 421 - Credits: 16.00
- **BSS 410** Systems engineering 410 - Credits: 16.00

**Recess training**
- **BPY 410** Practical training 410 - Credits: 16.00

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### 1.12 BEng Industrial Engineering Engage

**12136001**

Duration of study: 5 years

#### Curriculum: Year 1

**Minimum Credits: 128**

#### Semester one

**Fundamental**
- **UPO 112** Academic orientation 112 - Credits: 0.00

**Core**
- **CHM 171** General chemistry 171 - Credits: 16.00
- **HAS 110** Humanities and social sciences 110 - Credits: 8.00
- **JPO 110** Professional orientation 110 - Credits: 8.00
- **JPO 111** Additional Chemistry 1 111 - Credits: 8.00
- **JPO 116** Additional Mathematics 1 116 - Credits: 8.00
- **WTW 158** Calculus 158 - Credits: 16.00

#### Semester two

**Core**
- **FSK 176** Physics 176 - Credits: 16.00
- **HAS 120** Humanities and social sciences 120 - Credits: 8.00
- **JPO 120** Professional orientation 120 - Credits: 8.00
- **JPO 122** Additional Physics 122 - Credits: 8.00
- **JPO 126** Additional Mathematics 2 126 - Credits: 8.00
- **WTW 164** Mathematics 164 - Credits: 16.00

**Recess training**
- **WWP 121** Workshop practice 121 - Credits: 6.00
Curriculum: Year 2
Minimum Credits: 120
Semester one
Core
EBN 111  Electricity and electronics 111 - Credits: 16.00
JCP 203  Community-based project 203 - Credits: 8.00
JPO 112  Additional Electricity and electronics 112 - Credits: 8.00
JPO 113  Additional Graphical communication 113 - Credits: 8.00
MGC 110  Graphical communication 110 - Credits: 16.00
WTW 258  Calculus 258 - Credits: 8.00
Semester two
Core
JPO 123  Additional Materials science 123 - Credits: 8.00
JPO 125  Additional Mechanics 125 - Credits: 8.00
NMC 123  Materials science 123 - Credits: 16.00
SWK 122  Mechanics 122 - Credits: 16.00
WTW 263  Numerical methods 263 - Credits: 8.00
Curriculum: Year 3
Minimum Credits: 122
Semester one
Core
BJJ 210  Professional and technical communication 210 - Credits: 8.00
MOW 217  Manufacturing and design 217 - Credits: 16.00
MPR 213  Programming and information technology 213 - Credits: 16.00
MSD 210  Dynamics 210 - Credits: 16.00
WTW 256  Differential equations 256 - Credits: 8.00
Semester two
Core
BES 220  Engineering statistics 220 - Credits: 8.00
BPZ 220  Productivity 220 - Credits: 16.00
MTX 221  Thermodynamics 221 - Credits: 16.00
WTW 238  Mathematics 238 - Credits: 16.00
Curriculum: Year 4
Minimum Credits: 154
Semester one
Core
BAN 313  Industrial analysis 313 - Credits: 8.00
BER 310  Business law 310 - Credits: 16.00
BOB 310  Operational management 310 - Credits: 16.00
BOZ 312  Operational research 312 - Credits: 16.00
BSS 310  Engineering management 310 - Credits: 8.00
FBS 110  Financial management 110 - Credits: 10.00
MVS 311  Manufacturing systems 311 - Credits: 16.00
Semester two
Core
BFB 320  Facilities planning 320 - Credits: 8.00
BID 320  Information systems design 320 - Credits: 16.00
BLK 320  Industrial logistics 320 - Credits: 16.00
BUY 321  Simulation modelling 321 - Credits: 16.00
MIA 320  Engineering activity and group work 320 - Credits: 8.00
### Recess training
BPY 310  Practical training 310 - Credits: 16.00

### Curriculum: Final Year
**Minimum Credits: 144**

#### Semester one

**Core**
- BGC 410  Quality assurance 410 - Credits: 16.00
- BON 410  Operational research 410 - Credits: 16.00
- BPJ 410  Project 410 - Credits: 16.00
- BSR 410  Management accounting 410 - Credits: 16.00
- IPI 410  Engineering professionalism 410 - Credits: 8.00

#### Semester two

**Core**
- ABV 320  Labour relations 320 - Credits: 20.00
- BIE 420  Engineering economics 420 - Credits: 8.00
- BPJ 420  Project 420 - Credits: 24.00
- BPZ 421  Business engineering 421 - Credits: 16.00
- BSS 410  Systems engineering 410 - Credits: 16.00

**Recess training**
BPY 410  Practical training 410 - Credits: 16.00

### 1.13 BEng Mechanical Engineering

**12130004**
Duration of study: 4 years

#### Curriculum: Year 1
**Minimum Credits: 144**

#### Semester one

**Fundamental**
- UPO 112  Academic orientation 112 - Credits: 0.00

**Core**
- EBN 111  Electricity and electronics 111 - Credits: 16.00
- FSK 116  Physics 116 - Credits: 16.00
- HAS 110  Humanities and social sciences 110 - Credits: 8.00
- MGC 110  Graphical communication 110 - Credits: 16.00
- WTW 158  Calculus 158 - Credits: 16.00

#### Semester two

**Core**
- CHM 172  General chemistry 172 - Credits: 16.00
- HAS 120  Humanities and social sciences 120 - Credits: 8.00
- NMC 123  Materials science 123 - Credits: 16.00
- SWK 122  Mechanics 122 - Credits: 16.00
- WTW 164  Mathematics 164 - Credits: 16.00

**Recess training**
WWP 121  Workshop practice 121 - Credits: 6.00

#### Curriculum: Year 2
**Minimum Credits: 146**

#### Semester one

**Core**
- JCP 203  Community-based project 203 - Credits: 8.00
Engineering 2017

MJJ 210  Professional and technical communication 210 - Credits: 8.00
MOW 217  Manufacturing and design 217 - Credits: 16.00
MPR 213  Programming and information technology 213 - Credits: 16.00
MSD 210  Dynamics 210 - Credits: 16.00
WTW 256  Differential equations 256 - Credits: 8.00
WTW 258  Calculus 258 - Credits: 8.00

**Semester two**

**Core**
- BES 220  Engineering statistics 220 - Credits: 8.00
- MOW 227  Structural design 227 - Credits: 16.00
- MTX 221  Thermodynamics 221 - Credits: 16.00
- WTW 238  Mathematics 238 - Credits: 16.00
- WTW 263  Numerical methods 263 - Credits: 8.00

**Curriculum: Year 3**

**Minimum Credits: 144**

**Semester one**

**Core**
- BSS 310  Engineering management 310 - Credits: 8.00
- MOW 312  Machine design 312 - Credits: 16.00
- MSY 310  Structural mechanics 310 - Credits: 16.00
- MTV 310  Thermofluids 310 - Credits: 16.00
- MTX 311  Thermodynamics 311 - Credits: 16.00

**Semester two**

**Core**
- EIR 221  Electrical engineering 221 - Credits: 16.00
- MIA 320  Engineering activity and group work 320 - Credits: 8.00
- MKM 321  Solid mechanics 321 - Credits: 16.00
- MOW 323  Simulation-based design 323 - Credits: 16.00
- MVR 320  Vibration and noise 320 - Credits: 16.00

**Recess training**
- MPY 315  Practical training 315 - Credits: 16.00

**Curriculum: Final Year**

**Minimum Credits: 144**

**Semester one**

**Option: Mechanical and Aeronautical**

**Please note:** For the Aeronautical Option, the themes of both the Design and the Project must be aeronautical-related.

**Core**
- IPI 410  Engineering professionalism 410 - Credits: 8.00
- MKM 411  Computational fluid dynamics 411 - Credits: 16.00
- MOX 410  Design project 410 - Credits: 16.00
- MRN 412  Research project 412 - Credits: 16.00
- MTV 410  Thermofluids 410 - Credits: 16.00

**Semester two**

**Core**

**And either**

**Option – Mechanical**
- MBB 410  Control systems 410 - Credits: 16.00
- MRN 422  Research project 422 - Credits: 24.00
- MTV 420  Thermal and fluid machines 420 - Credits: 16.00
And one of the following:

**Elective**
- MAN 420 Porous flow 420 - Credits: 16.00
- MEG 421 Mechatronics 421 - Credits: 16.00
- MHM 420 Heat and mass transfer 420 - Credits: 16.00
- MII 420 Maintenance engineering 420 - Credits: 16.00
- MKI 420 Nuclear engineering 420 - Credits: 16.00
- MLV 420 Aeronautics 420 - Credits: 16.00
- MOO 420 Optimum design 420 - Credits: 16.00
- MUU 420 Fossil fuel power stations 420 - Credits: 16.00
- MVE 420 Vehicle engineering 420 - Credits: 16.00
- MWN 420 Numerical methods 420 - Credits: 16.00

Or

**Option – Aeronautical**
- MBB 410 Control systems 410 - Credits: 16.00
- MRN 422 Research project 422 - Credits: 24.00
- MTV 420 Thermal and fluid machines 420 - Credits: 16.00

**Elective**
- MLV 420 Aeronautics 420 - Credits: 16.00

**Recess training**
- MPY 415 Practical training - Credits: 16.00

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**1.14 BEng Mechanical Engineering Engage**

Duration of study: 5 years

**Curriculum: Year 1**

**Minimum Credits: 128**

**Semester one**

**Fundamental**
- UPO 112 Academic orientation 112 - Credits: 0.00

**Core**
- FSK 116 Physics 116 - Credits: 16.00
- HAS 110 Humanities and social sciences 110 - Credits: 8.00
- JPO 110 Professional orientation 110 - Credits: 8.00
- JPO 116 Additional Mathematics 1 116 - Credits: 8.00
- JPO 152 Additional Physics 152 - Credits: 8.00
- WTW 158 Calculus 158 - Credits: 16.00

**Semester two**

**Core**
- CHM 172 General chemistry 172 - Credits: 16.00
- HAS 120 Humanities and social sciences 120 - Credits: 8.00
- JPO 120 Professional orientation 120 - Credits: 8.00
- JPO 126 Additional Mathematics 2 126 - Credits: 8.00
- JPO 161 Additional Chemistry 1 161 - Credits: 8.00
- WTW 164 Mathematics 164 - Credits: 16.00

**Recess training**
- WWP 121 Workshop practice 121 - Credits: 6.00
Curriculum: Year 2
Minimum Credits: 120

Semester one
Core
EBN 111  Electricity and electronics 111 - Credits: 16.00
JCP 203  Community-based project 203 - Credits: 8.00
JPO 112  Additional Electricity and electronics 112 - Credits: 8.00
JPO 113  Additional Graphical communication 113 - Credits: 8.00
MGC 110  Graphical communication 110 - Credits: 16.00
WTW 258  Calculus 258 - Credits: 8.00

Semester two
Core
JPO 123  Additional Materials science 123 - Credits: 8.00
JPO 125  Additional Mechanics 125 - Credits: 8.00
NMC 123  Materials science 123 - Credits: 16.00
SWK 122  Mechanics 122 - Credits: 16.00
WTW 263  Numerical methods 263 - Credits: 8.00

Curriculum: Year 3
Minimum Credits: 122

Semester one
Core
MJJ 210  Professional and technical communication 210 - Credits: 8.00
MOW 217  Manufacturing and design 217 - Credits: 16.00
MPR 213  Programming and information technology 213 - Credits: 16.00
MSD 210  Dynamics 210 - Credits: 16.00
WTW 256  Differential equations 256 - Credits: 8.00

Semester two
Core
BES 220  Engineering statistics 220 - Credits: 8.00
MOW 227  Structural design 227 - Credits: 16.00
MTX 221  Thermodynamics 221 - Credits: 16.00
WTW 238  Mathematics 238 - Credits: 16.00

Curriculum: Year 3
Minimum Credits: 144

Semester one
Core
BSS 310  Engineering management 310 - Credits: 8.00
MOW 312  Machine design 312 - Credits: 16.00
MSY 310  Structural mechanics 310 - Credits: 16.00
MTV 310  Thermofluids 310 - Credits: 16.00
MTX 311  Thermodynamics 311 - Credits: 16.00

Semester two
Core
EIR 221  Electrical engineering 221 - Credits: 16.00
MIA 320  Engineering activity and group work 320 - Credits: 8.00
MKM 321  Solid mechanics 321 - Credits: 16.00
MOW 323  Simulation-based design 323 - Credits: 16.00
MVR 320  Vibration and noise 320 - Credits: 16.00

Recess training
MPY 315  Practical training 315 - Credits: 16.00
Curriculum: Final Year
Minimum Credits: 144
Semester one
Option: Mechanical and Aeronautical
Core
IPI 410 Engineering professionalism 410 - Credits: 8.00
MKM 411 Computational fluid dynamics 411 - Credits: 16.00
MOX 410 Design project 410 - Credits: 16.00
MRN 412 Research project 412 - Credits: 16.00
MTV 410 Thermofluids 410 - Credits: 16.00
Semester two
Core
And either
Option – Mechanical
MBB 410 Control systems 410 - Credits: 16.00
MRN 422 Research project 422 - Credits: 24.00
MTV 420 Thermal and fluid machines 420 - Credits: 16.00
And one of the following:
Elective
MAN 420 Porous flow 420 - Credits: 16.00
MEG 421 Mechatronics 421 - Credits: 16.00
MHM 420 Heat and mass transfer 420 - Credits: 16.00
MII 420 Maintenance engineering 420 - Credits: 16.00
MKI 420 Nuclear engineering 420 - Credits: 16.00
MLV 420 Aeronautics 420 - Credits: 16.00
MOO 420 Optimum design 420 - Credits: 16.00
MUU 420 Fossil fuel power stations 420 - Credits: 16.00
MVE 420 Vehicle engineering 420 - Credits: 16.00
MWN 420 Numerical methods 420 - Credits: 16.00
Or
Option – Aeronautical
MBB 410 Control systems 410 - Credits: 16.00
MRN 422 Research project 422 - Credits: 24.00
MTV 420 Thermal and fluid machines 420 - Credits: 16.00
Elective
MLV 420 Aeronautics 420 - Credits: 16.00
Recess training
MPY 415 Practical training - Credits: 16.00

1.15 BEng Metallurgical Engineering
12130005
Duration of study: 4 years

Curriculum: Year 1
Minimum Credits: 144
Semester one
Fundamental
UPO 112 Academic orientation 112 - Credits: 0.00
Core
CHM 171 General chemistry 171 - Credits: 16.00
HAS 110 Humanities and social sciences 110 - Credits: 8.00
Engineering 2017

MGC 110  Graphical communication 110 - Credits: 16.00
WTW 158  Calculus 158 - Credits: 16.00

**Semester two**

**Core**
EBN 122  Electricity and electronics 122 - Credits: 16.00
FSK 176  Physics 176 - Credits: 16.00
HAS 120  Humanities and social sciences 120 - Credits: 8.00
NMC 113  Materials science 113 - Credits: 16.00
SWK 122  Mechanics 122 - Credits: 16.00
WTW 164  Mathematics 164 - Credits: 16.00

**Recess training**
WWP 121  Workshop practice 121 - Credits: 6.00

**Curriculum: Year 2**

**Minimum Credits: 162**

**Semester one**

**Core**
GMI 210  Mineralogy 210 - Credits: 16.00
JCP 203  Community-based project 203 - Credits: 8.00
MPR 213  Programming and information technology 213 - Credits: 16.00
MSD 210  Dynamics 210 - Credits: 16.00
NJJ 210  Professional and technical communication 210 - Credits: 8.00
WTW 256  Differential equations 256 - Credits: 8.00
WTW 258  Calculus 258 - Credits: 8.00

**Semester two**

**Core**
BES 220  Engineering statistics 220 - Credits: 8.00
EIR 221  Electrical engineering 221 - Credits: 16.00
NMC 223  Materials science 223 - Credits: 16.00
NPT 220  Process thermodynamics 220 - Credits: 16.00
WTW 238  Mathematics 238 - Credits: 16.00
WTW 263  Numerical methods 263 - Credits: 8.00

**Curriculum: Year 3**

**Minimum Credits: 144**

**Semester one**

**Core**
BSS 310  Engineering management 310 - Credits: 8.00
MTV 310  Thermofluids 310 - Credits: 16.00
NEC 310  Electrochemistry 310 - Credits: 16.00
NMC 313  Materials science 313 - Credits: 16.00
NMP 310  Minerals processing 310 - Credits: 16.00

**Semester two**

**Core**
MIA 320  Engineering activity and group work 320 - Credits: 8.00
NEX 320  Excursions 320 - Credits: 8.00
NHM 322  Hydrometallurgy 322 - Credits: 16.00
NMM 320  Mechanical metallurgy 320 - Credits: 16.00
NPM 321  Pyrometallurgy 321 - Credits: 16.00
NVM 321  Refractory materials 321 - Credits: 8.00

**Recess training**
NPY 316  Industrial training 316 - Credits: 16.00
Curriculum: Final Year  
Minimum Credits: 136  
Semester one  
Core
IPI 410  Engineering professionalism 410 - Credits: 8.00  
NHM 412  Hydrometallurgy 412 - Credits: 16.00  
NMP 411  Minerals processing 411 - Credits: 16.00  
NPB 412  Process metallurgy and control 412 - Credits: 8.00  
NPW 411  Metals processing 411 - Credits: 16.00  
NSC 412  Literature survey 412 - Credits: 8.00  
Semester two  
Core
NOP 421  Process design 421 - Credits: 32.00  
NSC 422  Project 422 - Credits: 32.00  
Recess training
NPY 416  Industrial training 416 - Credits: 16.00  

1.16  BEng Metallurgical Engineering Engage  
12136005  
Duration of study: 5 years  
Curriculum: Year 1  
Minimum Credits: 128  
Semester one  
Fundamental
UPO 112  Academic orientation 112 - Credits: 0.00  
Core
FSK 116  Physics 116 - Credits: 16.00  
HAS 110  Humanities and social sciences 110 - Credits: 8.00  
JPO 110  Professional orientation 110 - Credits: 8.00  
JPO 116  Additional Mathematics 1 116 - Credits: 8.00  
JPO 152  Additional Physics 152 - Credits: 8.00  
WTW 158  Calculus 158 - Credits: 16.00  
Semester two  
Core
CHM 172  General chemistry 172 - Credits: 16.00  
HAS 120  Humanities and social sciences 120 - Credits: 8.00  
JPO 120  Professional orientation 120 - Credits: 8.00  
JPO 126  Additional Mathematics 2 126 - Credits: 8.00  
JPO 161  Additional Chemistry 1 161 - Credits: 8.00  
WTW 164  Mathematics 164 - Credits: 16.00  
Recess training
WWP 121  Workshop practice 121 - Credits: 6.00  
Curriculum: Year 2  
Minimum Credits: 120  
Semester one  
Core
EBN 111  Electricity and electronics 111 - Credits: 16.00  
JCP 203  Community-based project 203 - Credits: 8.00  
JPO 112  Additional Electricity and electronics 112 - Credits: 8.00
JPO 113  Additional Graphical communication 113 - Credits: 8.00
MGC 110  Graphical communication 110 - Credits: 16.00
WTW 258  Calculus 258 - Credits: 8.00

**Semester two**

**Core**
JPO 123  Additional Materials science 123 - Credits: 8.00
JPO 125  Additional Mechanics 125 - Credits: 8.00
NMC 123  Materials science 123 - Credits: 16.00
SWK 122  Mechanics 122 - Credits: 16.00
WTW 263  Numerical methods 263 - Credits: 8.00

**Curriculum: Year 3**
**Minimum Credits: 138**

**Semester one**

**Core**
GMI 210  Mineralogy 210 - Credits: 16.00
MPR 213  Programming and information technology 213 - Credits: 16.00
MSD 210  Dynamics 210 - Credits: 16.00
NJJ 210  Professional and technical communication 210 - Credits: 8.00
WTW 256  Differential equations 256 - Credits: 8.00

**Semester two**

**Core**
BES 220  Engineering statistics 220 - Credits: 8.00
EIR 221  Electrical engineering 221 - Credits: 16.00
NMC 223  Materials science 223 - Credits: 16.00
NPT 220  Process thermodynamics 220 - Credits: 16.00
WTW 238  Mathematics 238 - Credits: 16.00

**Curriculum: Year 4**
**Minimum Credits: 144**

**Semester one**

**Core**
BSS 310  Engineering management 310 - Credits: 8.00
MTV 310  Thermofluids 310 - Credits: 16.00
NEC 310  Electrochemistry 310 - Credits: 16.00
NMC 313  Materials science 313 - Credits: 16.00
NMP 310  Minerals processing 310 - Credits: 16.00

**Semester two**

**Core**
MIA 320  Engineering activity and group work 320 - Credits: 8.00
NEX 320  Excursions 320 - Credits: 8.00
NHM 322  Hydrometallurgy 322 - Credits: 16.00
NMM 320  Mechanical metallurgy 320 - Credits: 16.00
NPM 321  Pyrometallurgy 321 - Credits: 16.00
NVM 321  Refractory materials 321 - Credits: 8.00

**Recess training**
NPY 316  Industrial training 316 - Credits: 16.00
Curriculum: Final Year
Minimum Credits: 136

Semester one
Core
- IPI 410  Engineering professionalism 410 - Credits: 8.00
- NHM 412  Hydrometallurgy 412 - Credits: 16.00
- NMP 411  Minerals processing 411 - Credits: 16.00
- NPB 412  Process metallurgy and control 412 - Credits: 8.00
- NPW 411  Metals processing 411 - Credits: 16.00
- NSC 412  Literature survey 412 - Credits: 8.00

Semester two
Core
- NOP 421  Process design 421 - Credits: 32.00
- NSC 422  Project 422 - Credits: 32.00
Recess training
- NPY 416  Industrial training 416 - Credits: 16.00

1.17  BEng Mining Engineering
12130006
Duration of study: 4 years

Curriculum: Year 1
Minimum Credits: 144

Semester one
Fundamental
- UPO 112  Academic orientation 112 - Credits: 0.00
Core
- CHM 171  General chemistry 171 - Credits: 16.00
- HAS 110  Humanities and social sciences 110 - Credits: 8.00
- MGC 110  Graphical communication 110 - Credits: 16.00
- NMC 113  Materials science 113 - Credits: 16.00
- WTW 158  Calculus 158 - Credits: 16.00

Semester two
Core
- EBN 122  Electricity and electronics 122 - Credits: 16.00
- FSK 176  Physics 176 - Credits: 16.00
- HAS 120  Humanities and social sciences 120 - Credits: 8.00
- SWK 122  Mechanics 122 - Credits: 16.00
- WTW 164  Mathematics 164 - Credits: 16.00
Recess training
- PWP 121  Workshop practice 121 - Credits: 8.00

Curriculum: Year 2
Minimum Credits: 154

Semester one
Core
- JCP 203  Community-based project 203 - Credits: 8.00
- MPR 213  Programming and information technology 213 - Credits: 16.00
- MSD 210  Dynamics 210 - Credits: 16.00
- PJJ 210  Professional and technical communication 210 - Credits: 8.00
- SWK 210  Strength of materials 210 - Credits: 16.00
WTW 256  Differential equations 256 - Credits: 8.00
WTW 258  Calculus 258 - Credits: 8.00

**Semester two**

**Core**
BES 220  Engineering statistics 220 - Credits: 8.00
MTX 221  Thermodynamics 221 - Credits: 16.00
PMY 210  Virtual reality introduction to mining 210 - Credits: 8.00
SUR 220  Surveying 220 - Credits: 14.00
WTW 238  Mathematics 238 - Credits: 16.00
WTW 263  Numerical methods 263 - Credits: 8.00

**Recess training**
PPY 220  Experiential training 220 - Credits: 16.00

**Curriculum: Year 3**
**Minimum Credits: 144**

**Semester one**

**Core**
BSS 310  Engineering management 310 - Credits: 8.00
GLY 151  Introductory geology 151 - Credits: 16.00
MTV 310  Thermofluids 310 - Credits: 16.00
NMP 310  Minerals processing 310 - Credits: 16.00
PMY 311  Surface mining and geotechnics 311 - Credits: 16.00
PNB 300  Industrial excursions 300 - Credits: 8.00

**Semester two**

**Core**
MIA 320  Engineering activity and group work 320 - Credits: 8.00
PME 320  Mineral economics 320 - Credits: 16.00
PMY 320  Mining 320 - Credits: 16.00
PRX 321  Explosives engineering 321 - Credits: 8.00
PSC 321  Introduction to project 321 - Credits: 8.00

**Recess training**
PPY 320  Experiential training 320 - Credits: 16.00

**Curriculum: Final Year**
**Minimum Credits: 154**

**Semester one**

**Core**
GLY 365  Structural geology 365 - Credits: 18.00
IPI 410  Engineering professionalism 410 - Credits: 8.00
PEE 410  Mine ventilation engineering 410 - Credits: 16.00
PMY 410  Mining 410 - Credits: 16.00
PMY 423  Mine operational risk management 423 - Credits: 8.00
PSZ 410  Strata control 410 - Credits: 16.00

**Semester two**

**Core**
GLY 352  Geodynamics and ore formation 352 - Credits: 18.00
PMZ 422  Mine design and research 422 - Credits: 42.00
PNB 400  Industrial excursions 400 - Credits: 8.00
PSC 411  Project 411 - Credits: 10.00
1.18 BEng Mining Engineering Engage
12136006
Duration of study: 5 years

Curriculum: Year 1
Minimum Credits: 128
Semester one
Fundamental
UPO 112 Academic orientation 112 - Credits: 0.00
Core
FSK 116 Physics 116 - Credits: 16.00
HAS 110 Humanities and social sciences 110 - Credits: 8.00
JPO 110 Professional orientation 110 - Credits: 8.00
JPO 116 Additional Mathematics 1 116 - Credits: 8.00
JPO 152 Additional Physics 152 - Credits: 8.00
WTW 158 Calculus 158 - Credits: 16.00
Semester two
Core
CHM 172 General chemistry 172 - Credits: 16.00
HAS 120 Humanities and social sciences 120 - Credits: 8.00
JPO 120 Professional orientation 120 - Credits: 8.00
JPO 126 Additional Mathematics 2 126 - Credits: 8.00
JPO 161 Additional Chemistry 1 161 - Credits: 8.00
WTW 164 Mathematics 164 - Credits: 16.00
Recess training
PWP 121 Workshop practice 121 - Credits: 8.00

Curriculum: Year 2
Minimum Credits: 120
Semester one
Core
EBN 111 Electricity and electronics 111 - Credits: 16.00
JCP 203 Community-based project 203 - Credits: 8.00
JPO 112 Additional Electricity and electronics 112 - Credits: 8.00
JPO 113 Additional Graphical communication 113 - Credits: 8.00
MGC 110 Graphical communication 110 - Credits: 16.00
WTW 258 Calculus 258 - Credits: 8.00
Semester two
Core
JPO 123 Additional Materials science 123 - Credits: 8.00
JPO 125 Additional Mechanics 125 - Credits: 8.00
NMC 123 Materials science 123 - Credits: 16.00
PPY 220 Experiential training 220 - Credits: 16.00
SWK 122 Mechanics 122 - Credits: 16.00
WTW 263 Numerical methods 263 - Credits: 8.00

Curriculum: Year 3
Minimum Credits: 130
Semester one
Core
MPR 213 Programming and information technology 213 - Credits: 16.00
MSD 210 Dynamics 210 - Credits: 16.00
Engineering 2017

PJ 210 Professional and technical communication 210 - Credits: 8.00
SWK 210 Strength of materials 210 - Credits: 16.00
WTW 256 Differential equations 256 - Credits: 8.00

Semester two
Core
BES 220 Engineering statistics 220 - Credits: 8.00
MTX 221 Thermodynamics 221 - Credits: 16.00
PMY 210 Virtual reality introduction to mining 210 - Credits: 8.00
SUR 220 Surveying 220 - Credits: 14.00
WTW 238 Mathematics 238 - Credits: 16.00

Curriculum: Year 4
Minimum Credits: 144
Semester one
Core
BSS 310 Engineering management 310 - Credits: 8.00
GLY 151 Introductory geology 151 - Credits: 16.00
MTV 310 Thermofluids 310 - Credits: 16.00
NMP 310 Minerals processing 310 - Credits: 16.00
PMY 311 Surface mining and geotechnics 311 - Credits: 16.00
PNB 300 Industrial excursions 300 - Credits: 8.00

Semester two
Core
MIA 320 Engineering activity and group work 320 - Credits: 8.00
PME 320 Mineral economics 320 - Credits: 16.00
PMY 320 Mining 320 - Credits: 16.00
PRX 321 Explosives engineering 321 - Credits: 8.00
PSC 321 Introduction to project 321 - Credits: 8.00

Recess training
PPY 320 Experiential training 320 - Credits: 16.00

Curriculum: Final Year
Minimum Credits: 154
Semester one
Core
GLY 365 Structural geology 365 - Credits: 18.00
IPI 410 Engineering professionalism 410 - Credits: 8.00
PEE 410 Mine ventilation engineering 410 - Credits: 16.00
PMY 410 Mining 410 - Credits: 16.00
PMY 423 Mine operational risk management 423 - Credits: 8.00
PSZ 410 Strata control 410 - Credits: 16.00

Semester two
Core
GLY 352 Geodynamics and ore formation 352 - Credits: 18.00
PMZ 422 Mine design and research 422 - Credits: 42.00
PNB 400 Industrial excursions 400 - Credits: 8.00
PSC 411 Project 411 - Credits: 10.00
# REGULATIONS FOR POSTGRADUATE PROGRAMMES IN THE SCHOOL OF ENGINEERING AND THE GRADUATE SCHOOL OF TECHNOLOGY MANAGEMENT

Bachelor of Engineering Honours  
BEngHons programmes  

Bachelor of Science Honours in Applied Science  
[BScHons (Applied Science)]  

Bachelor of Science Honours in Technology Management  
[BScHons (Technology Management)]  

The programmes are arranged in alphabetical order according to the names of the academic departments.

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### 2.1 DEPARTMENT CHEMICAL ENGINEERING

#### 2.1.1 BEngHons Chemical Engineering

12240022  
Duration of study: 1 year

**Programme Information**

The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

**Admission Requirements**

Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.
Other programme-specific information
A limited number of appropriate modules from other departments and from other divisions of Chemical Engineering are allowed. Not all modules listed are presented each year. Please consult the departmental postgraduate brochure.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128
Core
It is compulsory that students do at least one of the following research modules within their selected area of specialisation:

CFT 732  Fluoro-materials science research and technology 732 - Credits: 32.00
CMS 732  Carbon materials science research and technology 732 - Credits: 32.00
CPW 732  Polymer materials science and research 732 - Credits: 32.00
CRO 700  Research orientation 700 - Credits: 32.0
CSP 732  Process control system research and development 732 - Credits: 32.00
WQB 780  Water quality management and research 780 - Credits: 32.00

Elective
CIP 732  Process integration 732 - Credits: 32.00
CIR 702  Chemical engineering 702 - Credits: 32.00
CPO 732  Product design 732 - Credits: 32.00
CRH 732  Bio-reaction engineering 732 - Credits: 32.00
CYM 732  Additive technology 732 - Credits: 32.00

2.1.2 BEngHons Control Engineering
12240232
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.
Admission Requirements
Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Other programme-specific information
A limited number of appropriate modules from other departments and from other divisions of Chemical Engineering are allowed. Not all modules listed are presented each year. Please consult the departmental postgraduate brochure.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree. Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128
Core
CBO 700 Multivariable control system design 700 - Credits: 32.00
CBT 700 Multivariable control system theory 700 - Credits: 32.00
CML 732 Model-based control laboratory 732 - Credits: 32.00
CSP 732 Process control system research and development 732 - Credits: 32.00

2.1.3 BEngHons Environmental Engineering
12240222
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.
Other programme-specific information
A limited number of appropriate modules from other departments and from other divisions of Chemical Engineering are allowed.
Not all modules listed are presented each year. Please consult the departmental postgraduate brochure.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128
Core
CAM 780 Air quality control 780 - Credits: 32.00
CEM 780 Principles of environmental engineering 780 - Credits: 32.00
WAI 780 Industrial waste engineering 780 - Credits: 32.00
WQB 780 Water quality management and research 780 - Credits: 32.00

2.1.4 BEngHons Water Utilisation Engineering
12240103
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Other programme-specific information
A limited number of appropriate modules from other departments and from other divisions of Chemical Engineering are allowed.
Not all modules listed are presented each year. Please consult the departmental postgraduate brochure.
Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).

ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.

iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.

iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.

v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128

Core
CIP 732  Process integration 732 - Credits: 32.00
CSK 732  Separation technology 732 - Credits: 32.00
WAI 780  Industrial waste engineering 780 - Credits: 32.00
WBG 780  Biological water treatment 780 - Credits: 32.00
WCW 780  Chemical water treatment 780 - Credits: 32.00
WQB 780  Water quality management and research 780 - Credits: 32.00

2.1.5 BScHons Applied Science Chemical Technology
12243004
Duration of study: 1 year

Programme Information
The BScHons (Applied Science) degree is conferred by the following academic departments:
- Chemical Engineering
- Civil Engineering
- Industrial and Systems Engineering
- Materials Science and Metallurgical Engineering
- Mechanical and Aeronautical Engineering
- Mining Engineering

Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as on the syllabi of the modules. The relevant departmental postgraduate brochures must also be consulted.
Admission Requirements
An appropriate bachelor’s degree, a BTech degree or equivalent qualification is required for admission.

Other programme-specific information
A limited number of appropriate postgraduate modules from other departments are allowed. Not all modules listed are presented each year. Please consult the departmental postgraduate brochure.
Specialisation in Process Technology is possible by registering for specific modules.
(Please note that a candidate selecting this option will not be allowed to register for any modules at 700-level before the modules of the first semester at 400-level had been completed successfully.) Please consult the department.
The modules CPB 410, CBI 410 and CSS 420 do not form part of the postgraduate block presentations.
Individual arrangements have to be made with the relevant lecturer regarding attendance of lectures, study material, tests and assignments.

Curriculum: Final Year
Minimum Credits: 128
Core
It is compulsory that students do at least one of the research modules within a selected area of specialisation.
CFT 732 Fluoro-materials science research and technology 732 - Credits: 32.00
CMS 732 Carbon materials science research and technology 732 - Credits: 32.00
CPW 732 Polymer materials science and research 732 - Credits: 32.00
CBP 732 Bioprocessing 732 - Credits: 32.00
CIP 732 Process integration 732 - Credits: 32.00
CIR 707 Chemical engineering 707 - Credits: 32.00
CIR 787 Chemical Engineering 787 - Credits: 16.00
CPA 410 Particle technology 410 - Credits: 16.00
CPB 410 Process control 410 - Credits: 16.00
CPO 732 Product design 732 - Credits: 32.00
CPP 732 Polymer processing 732 - Credits: 32.00
CRO 410 Reactor design 410 - Credits: 16.00
CSK 732 Separation technology 732 - Credits: 32.00
CSS 420 Specialisation 420 - Credits: 16.00
CYM 732 Additive technology 732 - Credits: 32.00

2.1.6 BScHons Applied Science Environmental Technology
12243008
Duration of study: 1 year

Programme Information
The BScHons (Applied Science) degree is conferred by the following academic departments:
- Chemical Engineering
- Civil Engineering
- Industrial and Systems Engineering
- Materials Science and Metallurgical Engineering
• Mechanical and Aeronautical Engineering
• Mining Engineering

Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as on the syllabi of the modules. The relevant departmental postgraduate brochures must also be consulted.

Admission Requirements
An appropriate bachelor’s degree, a BTech degree or equivalent qualification.

Other programme-specific information
A limited number of appropriate postgraduate modules from other departments are allowed. Not all modules listed are presented each year. Please consult the departmental postgraduate brochure.

Curriculum: Final Year
Minimum Credits: 128

Core
CAM 787 Air quality control 787 - Credits: 32.00
CEM 787 Principles of environmental engineering 787 - Credits: 32.00
WAI 787 Industrial waste engineering 787 - Credits: 32.00
WQB 787 Water quality management and research 787 - Credits: 32.00

2.1.7 BScHons Applied Science Water Utilisation
12243014
Duration of study: 1 year

Programme Information
The BScHons (Applied Science) degree is conferred by the following academic departments:
• Chemical Engineering
• Civil Engineering
• Industrial and Systems Engineering
• Materials Science and Metallurgical Engineering
• Mechanical and Aeronautical Engineering
• Mining Engineering

Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as on the syllabi of the modules. The relevant departmental postgraduate brochures must also be consulted.

Admission Requirements
An appropriate bachelor’s degree, a BTech degree or equivalent qualification.
Other programme-specific information
A limited number of appropriate postgraduate modules from other departments are allowed. Not all modules listed are presented each year. Please consult the departmental postgraduate brochure.

Curriculum: Final Year
Minimum Credits: 128
Core
WAI 787  Industrial waste engineering 787 - Credits: 32.00
WBW 787  Biological water treatment 787 - Credits: 32.00
WCW 787  Chemical water treatment 787 - Credits: 32.00
WQB 787  Water quality management and research 787 - Credits: 32.00

2.2  DEPARTMENT CIVIL ENGINEERING

2.2.1  BEngHons Geotechnical Engineering
12240215
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).
Engineering 2017

Curriculum: Final Year
Minimum Credits: 128
All students must complete the module SSC 780 Civil Research 780 listed below.

Core
SSC 780 Civil research 780 (Compulsory module) - Credits: 32.00
SHC 798 Applied statistical methods and optimisation 798 - Credits: 24.00
SIK 790 Numerical methods and finite element applications for Civil Engineers 790 - Credits: 24.00

Elective
IGL 703 Engineering geology 703 - Credits: 16.00
SGS 787 Analytical soil mechanics 787 - Credits: 24.00
SGS 788 Theoretical soil mechanics 788 - Credits: 24.00
SGS 789 Specialised geotechnical testing 789 - Credits: 24.00

2.2.2 BEngHons Structural Engineering
12240122
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128
All students must complete the module SSC 780 Civil Research 780 listed below.
Core
SSC 780  Civil research 780 (Compulsory module) - Credits: 32.00
SGS 787  Analytical soil mechanics 787 - Credits: 24.00
SGS 788  Theoretical soil mechanics 788 - Credits: 24.00
SGS 789  Specialised geotechnical testing 789 - Credits: 24.00

Elective
IGL 703  Engineering geology 703 - Credits: 16.00
SHC 798  Applied statistical methods and optimisation 798 - Credits: 24.00
SIK 790  Numerical methods and finite element applications for Civil Engineers 790 - Credits: 24.00

2.2.3 BEngHons Transportation Engineering
12240112
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128
All students must complete the module SSC 780 Civil Research 780 listed below.
Core
SSC 780  Civil research 780 (Compulsory module) - Credits: 32.00
SHC 798  Applied statistical methods and optimisation 798 - Credits: 24.00
2.2.4 BEngHons Water Resources Engineering
12240162
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128
All students must complete the module SSC 780 Civil Research 780 listed below.
Core
SSC 780 Civil research 780 (Compulsory module) - Credits: 32.00
Elective
SHC 794  Free surface flow 794 - Credits: 24.00
SHC 798  Applied statistical methods and optimisation 798 - Credits: 24.00
SHW 785  Pump systems 785 - Credits: 24.00
SIK 790 Numerical methods and finite element applications for Civil Engineers 790 - Credits: 24.00
SSI 790  Infrastructure management 790 - Credits: 24.00

2.2.5 BScHons Applied Science Geotechnics
12243005
Duration of study: 1 year

Programme Information
The BScHons (Applied Science) degree is conferred by the following academic departments:
- Chemical Engineering
- Civil Engineering
- Industrial and Systems Engineering
- Materials Science and Metallurgical Engineering
- Mechanical and Aeronautical Engineering
- Mining Engineering

Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as on the syllabi of the modules. The relevant departmental postgraduate brochures must also be consulted.

Admission Requirements
An appropriate bachelor's degree, a BTech degree or equivalent qualification.

Other programme-specific information
The remainder of the credits to be chosen from the modules prescribed for the BEngHons (Geotechnical Engineering) programme, as approved by the head of department, and after completion of the appropriate modules as listed. The modules CPB 410, CBI 410 and CSS 420 do not form part of the postgraduate block presentations. Individual arrangements have to be made with the relevant lecturer regarding attendance of lectures, study material, tests and assignments.

Curriculum: Final Year
Minimum Credits: 128
All students must complete the module SSC 780 Civil Research 780 listed below.

Core
SSC 780  Civil research 780 (Compulsory module) - Credits: 32.00
SGS 787  Analytical soil mechanics 787 - Credits: 24.00
SGS 788  Theoretical soil mechanics 788 - Credits: 24.00
SGS 789  Specialised geotechnical testing 789 - Credits: 24.00
SHC 797  Basic statistical methods 797 - Credits: 24.00
SGM 785  Basic soil mechanics 785 - Credits: 24.00
2.2.6 BScHons Applied Science Structures
12243034
Duration of study: 1 year

Programme Information
The BScHons (Applied Science) degree is conferred by the following academic departments:
- Chemical Engineering
- Civil Engineering
- Industrial and Systems Engineering
- Materials Science and Metallurgical Engineering
- Mechanical and Aeronautical Engineering
- Mining Engineering

Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as on the syllabi of the modules. The relevant departmental postgraduate brochures must also be consulted.

Admission Requirements
An appropriate bachelor's degree, a BTech degree or equivalent qualification is required for admission.

Other programme-specific information
The remainder of the credits to be chosen from the modules prescribed for the BEngHons (Structural Engineering) programme, as approved by the head of department, and after completion of the appropriate modules as listed. The modules CPB 410, CBI 410 and CSS 420 do not form part of the postgraduate block presentations. Individual arrangements have to be made with the relevant lecturer regarding attendance of lectures, study material, tests and assignments.

Curriculum: Final Year
Minimum Credits: 128
All students must complete the module SSC 780 Civil Research 780 listed below.

Core
- SSC 780 Civil research 780 (Compulsory module) - Credits: 32.00
- SIC 790 Basic structural analysis 790 - Credits: 24.00
- SIC 793 Basic structural design 793 - Credits: 24.00

and the remainder of the credits chosen from the modules prescribed for the BEngHons (Structural Engineering) programme, as approved by the head of department, and after completion of the appropriate modules from the list above.
2.2.7 BScHons Applied Science Transportation Planning

12243009
Duration of study: 1 year

Programme Information
The BScHons (Applied Science) degree is conferred by the following academic departments:
- Chemical Engineering
- Civil Engineering
- Industrial and Systems Engineering
- Materials Science and Metallurgical Engineering
- Mechanical and Aeronautical Engineering
- Mining Engineering

Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as on the syllabi of the modules. The relevant departmental postgraduate brochures must also be consulted.

Admission Requirements
An appropriate bachelor's degree, a BTech degree or equivalent qualification.

Other programme-specific information
The remainder of the credits to be chosen from the modules for the BEngHons (Transportation Engineering) programme, as approved by the head of department, and after completion of the appropriate modules as listed. The modules CPB 410, CBI 410 and CSS 420 do not form part of the postgraduate block presentations. Individual arrangements have to be made with the relevant lecturer regarding attendance of lectures, study material, tests and assignments.

Curriculum: Final Year
Minimum Credits: 128

All students must complete the module SSC 780 Civil Research 780 listed below.

Core
- SSC 780 Civil research 780 (Compulsory module) - Credits: 32.00
- SGM 787 Basic pavements and transportation 787 - Credits: 24.00
- SHC 797 Basic statistical methods 797 - Credits: 24.00
- SVC 789 Transportation planning 789 - Credits: 24.00

Elective
- SSI 790 Infrastructure management 790 - Credits: 24.00
- SVC 791 Transportation special 791 - Credits: 24.00
- SVV 788 Multimodal transport 788 - Credits: 24.00
- SVV 791 Geometric design and safety 791 - Credits: 24.00
2.2.8 BScHons Applied Science Water Resources
12243033
Duration of study: 1 year

Programme Information
The BScHons (Applied Science) degree is conferred by the following academic departments:
- Chemical Engineering
- Civil Engineering
- Industrial and Systems Engineering
- Materials Science and Metallurgical Engineering
- Mechanical and Aeronautical Engineering
- Mining Engineering

Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as on the syllabi of the modules. The relevant departmental postgraduate brochures must also be consulted.

Admission Requirements
An appropriate bachelor's degree, a BTech degree or equivalent qualification is required for admission.

Other programme-specific information
The remainder of the modules must be chosen from the modules prescribed for the BEngHons (Water Resource Engineering) programme, as approved by the head of department, and after completion of the appropriate modules as listed. The modules CPB 410, CBI 410 and CSS 420 do not form part of the postgraduate block presentations. Individual arrangements have to be made with the relevant lecturer regarding attendance of lectures, study material, tests and assignments.

Curriculum: Final Year
Minimum Credits: 128
All students must complete the module SSC 780 Civil Research 780 listed below.

Core
SSC 780 Civil research 780 (Compulsory module) - Credits: 32.00
SHC 797 Basic statistical methods 797 - Credits: 24.00
SHW 788 Basic hydraulics 788 - Credits: 24.00

Elective
SHC 794 Free surface flow 794 - Credits: 24.00
SHW 785 Pump systems 785 - Credits: 24.00
2.3 ELECTRICAL, ELECTRONIC AND COMPUTER ENGINEERING

2.3.1 BEngHons Electrical Engineering
12240032
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Other programme-specific information
Students may take modules to the value of 32 credits from other fields of specialisation or from other departments, with approval of the Coordinator: Postgraduate Studies.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128

Core
It is compulsory that students must do:
EIN 732 Introduction to research 732 (compulsory) - Credits: 32
But with special permission from the department, this module may be substituted by:
EPT 732 Research project: Theory 732 - Credits: 32.00
Or
EPT 733 Research project: Design and laboratory 733 - Credits: 32.00

EED 780 Power electronics 780 - Credits: 32.00
2.3.2 BEngHons Electronic Engineering
12240092
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of the General Regulations, Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Other programme-specific information
Students may take modules to the value of 32 credits from other fields of specialisation or from other departments, with approval of the Coordinator: Postgraduate Studies.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128
Core
It is compulsory that students must do:
EIN 732 Introduction to research 732 (compulsory) - Credits: 32
But with special permission from the department, this module may be substituted by:
EPT 732 Research project: Theory 732 - Credits: 32.00
Or
### 2.3.3 BEngHons Computer Engineering

12240214  
**Duration of study:** 1 year

#### Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

#### Admission Requirements
Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

#### Other programme-specific information
Students may take modules to the value of 32 credits from other fields of specialisation or from other departments, with approval of the Coordinator: Postgraduate Studies.

#### Examinations and pass requirements

i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).

ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.

iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.

iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.

v. No supplementary or special examinations are granted at postgraduate level.

#### Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

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<thead>
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<tr>
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<tr>
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<td>EGH 732</td>
<td>Renewable energy 732</td>
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<td>Electronic defence - electronic countermeasures 780</td>
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<td>ETD 732</td>
<td>Digital communications 732</td>
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<td>ETT 732</td>
<td>Telecommunication systems engineering 732</td>
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</table>
Curriculum: Final Year
Minimum Credits: 128

Core
It is compulsory that students must do:
EIN 732 Introduction to research 732 (compulsory) - Credits: 32
But with special permission from the department, this module may be substituted by:
EPT 732 Research project: Theory 732 - Credits: 32.00
Or
EPT 733 Research project: Design and laboratory 733 - Credits: 32.00
EAI 732 Intelligent systems 732 - Credits: 32.00
EAI 733 Advanced topics in intelligent systems 733 - Credits: 32.00
EGH 732 Renewable energy 732 - Credits: 32.00
EKS 732 Wireless sensor networks 732 - Credits: 32.00
ELB 780 Electronic defence - electronic countermeasures 780 - Credits: 32.00
ELB 781 Electronic defence - electronic support 781 - Credits: 32.00
ERN 780 Computer networks 780 - Credits: 32.00

2.3.4 BEngHons Bioengineering
12240203
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Other programme-specific information
Students may take modules to the value of 32 credits from other fields of specialisation or from other departments, with approval of the Coordinator: Postgraduate studies. It is a requirement that a student must complete all three the bioengineering honours modules, as well as Introduction to research 732 (EIN 732), to enroll for a master’s or a PhD in Bioengineering.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.
Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128

Core
EBB 732  Biosignals and systems 732 - Credits: 32.00
EBE 732  Bioelectricity and electronics 732 - Credits: 32.00
EBI 732  Bioelectromagnetism and modelling 732 - Credits: 32.00
It is compulsory that students must do:
EIN 732  Introduction to research 732 (compulsory) - Credits: 32
But with special permission from the department, this module may be substituted by:
EPT 732  Research project: Theory 732 - Credits: 32.00
Or
EPT 733  Research project: Design and laboratory 733 - Credits: 32.00

2.3.5 BEngHons Microelectronic Engineering
12240192
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits.
The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Other programme-specific information
Students may take modules to the value of 32 credits from other fields of specialisation or from other departments, with approval of the Coordinator: Postgraduate Studies.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.
Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128
Core
It is compulsory that students must do:
EIN 732 Introduction to research 732 (compulsory) - Credits: 32
But with special permission from the department, this module may be substituted by:
EPT 732 Research project: Theory 732 - Credits: 32.00
Or
EPT 733 Research project: Design and laboratory 733 - Credits: 32.00

The remaining of the modules must be choosen in consultation and with the approval of the Head of department/Coordinator: Postgraduate studies.

2.4 DEPARTMENT ENGINEERING AND TECHNOLOGY MANAGEMENT

2.4.1 BEngHons Technology Management
12240252
Duration of study: 1 year

Programme Information
The BEngHons (Technology Management) degree is conferred by the following academic department: Engineering and Technology Management.

The stipulations of Faculty Regulations for honours degrees apply mutatis mutandis.

Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as on the syllabi of the modules.

The relevant departmental postgraduate brochures must be consulted. The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of the General Regulations, Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.

iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.

iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.

v. No supplementary or special examinations are granted at postgraduate level.

**Pass with Distinction**
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

**Curriculum: Final Year**
**Minimum Credits: 128**

**Core**
- IGB 780 Research project 780 - Credits: 32.00
- IKN 780 Techo economics 780 - Credits: 16.00
- INV 780 Organisation and innovation 780 - Credits: 16.00
- IPK 780 Project management 780 - Credits: 16.00
- ISE 780 Systems thinking 780 - Credits: 16.00

**Elective**
- IBB 780 Asset management 780 - Credits: 16.00
- IEE 780 Technological entrepreneurship 780 - Credits: 16.00
- IMC 780 Maintenance management 780 - Credits: 16.00
- IVV 781 Operations management 781 - Credits: 16.00

**2.4.2 BScHons Technology Management**

12241073
Duration of study: 1 year

**Programme Information**
The BScHons (Technology Management) degree is conferred by the following academic department: Engineering and Technology Management.
The stipulations of Faculty Regulations for honours degrees apply mutatis mutandis.
Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as on the syllabi of the modules. The relevant departmental postgraduate brochures must be consulted.

**Admission Requirements**
An appropriate bachelor's degree, a BTech degree or equivalent qualification is required for admission.
Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128

Core
- IKN 780 Techo economics 780 - Credits: 16.00
- INV 780 Organisation and innovation 780 - Credits: 16.00
- IPK 780 Project management 780 - Credits: 16.00
- ISC 780 Research project 780 - Credits: 32.00
- ISE 780 Systems thinking 780 - Credits: 16.00

Elective
- IBB 780 Asset management 780 - Credits: 16.00
- IEE 780 Technological entrepreneurship 780 - Credits: 16.00
- IMC 780 Maintenance management 780 - Credits: 16.00
- IVV 781 Operations management 781 - Credits: 16.00

2.5 DEPARTMENT INDUSTRIAL AND SYSTEMS ENGINEERING

2.5.1 BEngHons Industrial Engineering
12240012
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of the General Regulations, Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.
Other programme-specific information
An appropriate bouquet of 8 modules must be selected in consultation with the Head of Department to comply with the requirements for one of the following domains of specialisation:

- Resource Optimisation (RO)
- Supply Chain Engineering (SCE)
- Business Process Management (BPM)

Industrial Engineers are not allowed more than 2 appropriate modules from other departments. Non-Industrial Engineers are not allowed more than 1 appropriate module from other departments. A maximum of 3 approved modules may be selected from other departments.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128

Core
Please note: BCS 780 is a compulsory module

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<th>Module Code</th>
<th>Module Title</th>
<th>Credits</th>
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<tr>
<td>BCS 780</td>
<td>Industrial and systems engineering research 780</td>
<td>32.00</td>
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<tr>
<td>BAR 780</td>
<td>Solution algorithms in operations research 780</td>
<td>32.00</td>
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<tr>
<td>BBA 781</td>
<td>Enterprise engineering and research methods 781</td>
<td>32.00</td>
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<tr>
<td>BDE 780</td>
<td>Design and analysis of experiments 780</td>
<td>16.00</td>
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<td>BGH 780</td>
<td>Quality management 780</td>
<td>16.00</td>
</tr>
<tr>
<td>BLK 781</td>
<td>Supply chain processes 781</td>
<td>16.00</td>
</tr>
<tr>
<td>BOZ 780</td>
<td>Operations research 780</td>
<td>32.00</td>
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<td>BPZ 782</td>
<td>Manufacturing planning systems 782</td>
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</tr>
<tr>
<td>BVK 780</td>
<td>Supply chain design 780</td>
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2.5.2 BScHons Applied Science Industrial Systems
12243002
Duration of study: 1 year

Programme Information
The BScHons (Applied Science) degree is conferred by the following academic departments:
- Chemical Engineering
- Civil Engineering
- Industrial and Systems Engineering
- Materials Science and Metallurgical Engineering
- Mechanical and Aeronautical Engineering
- Mining Engineering

Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as on the syllabi of the modules. The relevant departmental postgraduate brochures must also be consulted.

Admission Requirements
An appropriate bachelor’s degree, a BTech degree or equivalent qualification.

Other programme-specific information
The modules CPB 410, CBI 410 and CSS 420 do not form part of the postgraduate block presentations. Individual arrangements have to be made with the relevant lecturer regarding attendance of lectures, study material, tests and assignments.

Curriculum: Final Year
Minimum Credits: 128

Core
Please note: BCS 780 is a compulsory module

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<thead>
<tr>
<th>Module</th>
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<tr>
<td>BCS 780</td>
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<td>BAN 780</td>
<td>Industrial analysis 780</td>
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<td>BAR 780</td>
<td>Solution algorithms in operations research 780</td>
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<td>BBA 781</td>
<td>Enterprise engineering and research methods 781</td>
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<td>Supply chain processes 781</td>
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<td>Manufacturing planning systems 782</td>
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<tr>
<td>BVK 780</td>
<td>Supply chain design 780</td>
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2.6 DEPARTMENT OF MATERIALS SCIENCE AND METALLURGICAL ENGINEERING

2.6.1 BEngHons Metallurgical Engineering
12240063
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 120/150 credits (depending on the degree). The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of the General Regulations, Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Other programme-specific information
A limited number of appropriate modules from other departments are allowed.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 120/150 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 120

Compulsory module
NLO 700 Research project 700 (compulsory) - Credits: 30.00

Core
And the balance of the credits (for a total of at least 120) chosen from the following modules as approved by the head of department.
NEL 700 Electrometallurgy 700 - Credits: 30.00
NFE 700 Fabrication engineering 700 - Credits: 30.00
NFM 700 Physical metallurgy 700 - Credits: 30.00
NHB 700 Heat treatment 700 - Credits: 30.00
NMR 700 Hydrometallurgy 700 - Credits: 30.00
NKR 700 Corrosion 700 - Credits: 30.00
NNM 700 Mechanical metallurgy 700 - Credits: 30.00
NMP 700 Minerals processing 700 - Credits: 30.00
NMP 701 Applied theory of sampling for minerals processing 701 - Credits: 30.00
NNR 700 Nuclear reactor materials 700 - Credits: 30.00
NPA 700 Metallurgical analysis 700 - Credits: 16.00
NPM 700 Pyrometallurgy 700 - Credits: 30.00
NS 700 Froth flotation 700 - Credits: 30.00
NSW 700 Welding metallurgy 700 - Credits: 30.00
NVM 700 Refractory materials 700 - Credits: 30.00
NWM 700 Mathematical modelling of metallurgical processes and materials 700 - Credits: 30.00
NWP 700 Welding processes 700 - Credits: 30.00
NWP 701 Design of welded structures 701 - Credits: 30.00

2.6.2 BEngHons Metallurgical Engineering: Welding
12240064
Duration of study: 1 year

Curriculum: Final Year
Minimum Credits: 150

Compulsory module
NLO 700 Research project 700 (compulsory) - Credits: 30.00

Core
NFE 700 Fabrication engineering 700 - Credits: 30.00
NSW 700 Welding metallurgy 700 - Credits: 30.00
NWP 700 Welding processes 700 - Credits: 30.00
NWP 701 Design of welded structures 701 - Credits: 30.00

2.6.3 BSChHons Applied Science Metallurgy
12243007
Duration of study: 1 year

Programme Information
The BSChHons (Applied Science) degree is conferred by the following academic departments:
- Chemical Engineering
- Civil Engineering
- Industrial and Systems Engineering
- Materials Science and Metallurgical Engineering
- Mechanical and Aeronautical Engineering
- Mining Engineering

Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as on the syllabi of the modules. The relevant departmental postgraduate brochures must also be consulted.
Admission Requirements
An appropriate bachelor's degree, a BTech degree or equivalent qualification.

Other programme-specific information
A limited number of appropriate modules from other departments and from other divisions of Chemical Engineering are allowed. Not all modules listed are presented each year. Please consult the departmental postgraduate brochure.

Curriculum: Final Year
Minimum Credits: 120

Bridging module
One of the following bridging modules is compulsory
NFM 701 Basic physical metallurgy 701 - Credits: 0.00
NHM 701 Basic extractive metallurgy 701 - Credits: 0.00
NPM 701 Basic pyrometallurgy 701 - Credits: 0.00

Compulsory core module
NLO 700 Research project 700 (compulsory) - Credits: 30.00

Electives
And the balance of the credits (for a total of at least 120) chosen from the modules for the BEngHons programme, as approved by the head of department and after successful completion of the appropriate 701 module.
NEL 700 Electrometallurgy 700 - Credits: 30.00
NFE 700 Fabrication engineering 700 - Credits: 30.00
NFM 700 Physical metallurgy 700 - Credits: 30.00
NHB 700 Heat treatment 700 - Credits: 30.00
NHM 700 Hydrometallurgy 700 - Credits: 30.00
NKR 700 Corrosion 700 - Credits: 30.00
NMM 700 Mechanical metallurgy 700 - Credits: 30.00
NMP 700 Minerals processing 700 - Credits: 30.00
NMP 701 Applied theory of sampling for minerals processing 701 - Credits: 30.00
NNR 700 Nuclear reactor materials 700 - Credits: 30.00
NPA 700 Metallurgical analysis 700 - Credits: 16.00
NPM 700 Pyrometallurgy 700 - Credits: 30.00
NSW 700 Welding metallurgy 700 - Credits: 30.00
NVM 700 Refractory materials 700 - Credits: 30.00
NWM 780 Mathematical modelling of metallurgical processes and materials 780 - Credits: 30.00
NWP 700 Welding processes 700 - Credits: 30.00
NWP 701 Design of welded structures 701 - Credits: 30.00

2.6.4 BScHons Applied Science Metallurgy Welding Technology
12243036
Duration of study: 1 year

Curriculum: Final Year
Minimum Credits: 150

Bridging module
NFM 701 Basic physical metallurgy 701 - Credits: 0.00
Compulsory module
NLO 700 Research project 700 (compulsory) - Credits: 30.00

Core
NFE 700 Fabrication engineering 700 - Credits: 30.00
NSW 700 Welding metallurgy 700 - Credits: 30.00
NWP 700 Welding processes 700 - Credits: 30.00
NWP 701 Design of welded structures 701 - Credits: 30.00

2.7 DEPARTMENT MECHANICAL AND AERONAUTICAL ENGINEERING

2.7.1 BEngHons Mechanical Engineering
12240052
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Other programme-specific information
All students must complete the module MSS 732 Research study 732 listed below. A limited number of appropriate modules from other departments are allowed. Not all modules listed are presented each year. Please consult the departmental post-graduate brochure.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).
ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.
iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.
iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.
v. No supplementary or special examinations are granted at postgraduate level.

Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).
Curriculum: Final Year
Minimum Credits: 128

Core

Please note: MSS 732 Research study 732 listed below is a compulsory module

MSS 732 Research study 732 (compulsory) - Credits: 32.00
MAE 780 Aeroelasticity 780 - Credits: 16.00
MAY 780 Aircraft propulsion 780 - Credits: 16.00
MBB 780 Control Systems 780 - Credits: 16.00
MCT 780 Non-destructive testing 780 - Credits: 16.00
MEE 781 Advanced finite element methods 781 - Credits: 16.00
MEG 780 Mechatronics 780 - Credits: 16.00
MHM 780 Advanced heat and mass transfer 780 - Credits: 16.00
MIC 780 Condition-based maintenance 780 - Credits: 16.00
MIP 780 Maintenance practice 780 - Credits: 16.00
MIP 782 Maintenance logistics 782 - Credits: 16.00
MIR 781 Reliability engineering 781 - Credits: 16.00
MLD 780 Aerodynamics 780 - Credits: 16.00
MLD 781 Missile aerodynamics and design 781 - Credits: 16.00
MLD 782 Experimental methods 782 - Credits: 16.00
MLD 784 Avionics 784 - Credits: 16.00
MLD 783 Unmanned aircraft systems technology 783 - Credits: 16.00
MLT 780 Aeronautical structures 780 - Credits: 16.00
MLV 780 Flight mechanics 780 - Credits: 16.00
MOO 780 Optimum design 780 - Credits: 16.00
MOX 781 Specialised design 781 - Credits: 16.00
MOX 782 Specialised design 782 - Credits: 16.00
MSF 780 Fracture mechanics 780 - Credits: 16.00
MSM 780 Numerical thermoflow 780 - Credits: 16.00
MSM 781 Numerical thermoflow 781 - Credits: 16.00
MSV 780 Fatigue 780 - Credits: 16.00
MSX 780 Fluid mechanics 780 - Credits: 16.00
MSX 781 Advanced fluid mechanics 781 - Credits: 16.00
MSY 781 Specialised structural mechanics 781 - Credits: 16.00
MSY 783 Experimental structural dynamics 783 - Credits: 16.00
MTX 781 Advanced thermodynamics and energy systems 781 - Credits: 16.00
MUU 781 Fossil fuel power stations 781 - Credits: 16.00
MWN 780 Numerical methods 780 - Credits: 16.00

2.7.2 BScHons Applied Science Mechanics
12243006
Duration of study: 1 year

Programme Information
The BScHons (Applied Science) degree is conferred by the following academic departments:

- Chemical Engineering
- Civil Engineering
Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as on the syllabi of the modules. The relevant departmental postgraduate brochures must also be consulted.

**Admission Requirements**
An appropriate bachelor's degree, a BTech degree or equivalent qualification.

**Curriculum: Final Year**

**Minimum Credits: 128**

**Core**
MSS 732  Research study 732 - Credits: 32.00 (compulsory)

**And**
Any one of the following three 32 credit module combinations; both modules in a combination must be completed in the first semester of registration in the programme:

The combination of:
MSV 780  Fatigue 780 - Credits: 16.00
MEE 780  Finite element methods 780 - Credits: 16.00

**Or**
The combination of:
MSX 780  Fluid mechanics 780 - Credits: 16.00
MSM 780  Numerical thermoflow 780 - Credits: 16.00

**Or**
The combination of:
MIP 780  Maintenance practice 780 - Credits: 16.00
MIR 781  Reliability engineering 781 - Credits: 16.00

*(If a student fails any one of the two 16 credit modules in the selected combination, this may be taken as grounds for termination of the registration of the student, in terms of the General Regulations. G.4 and G.19.)*

**And**
In addition to the compulsory module MSS 732 Research study 732, at least 64 credits chosen from the modules as prescribed for the BEngHons programme, as approved by the head of department, and subject to concurrent registration prerequisite requirements published in the departmental postgraduate brochure.

**Elective**
MAE 780  Aeroelasticity 780 - Credits: 16.00
MAY 780  Aircraft propulsion 780 - Credits: 16.00
MBB 780  Control Systems 780 - Credits: 16.00
MCT 780  Non-destructive testing 780 - Credits: 16.00
MEE 781  Advanced finite element methods 781 - Credits: 16.00
MEG 780  Mechatronics 780 - Credits: 16.00
MHM 780  Advanced heat and mass transfer 780 - Credits: 16.00
MIC 780  Condition-based maintenance 780 - Credits: 16.00
MIP 782  Maintenance logistics 782 - Credits: 16.00
MLD 781  Missile aerodynamics and design 781 - Credits: 16.00
MLD 782  Experimental methods 782 - Credits: 16.00
2.8 DEPARTMENT MINING ENGINEERING

2.8.1 BEngHons Mining Engineering

12240072
Duration of study: 1 year

Programme Information
The curriculum is determined in consultation with the relevant heads of departments. A student is required to pass modules to the value of at least 128 credits. The degree is awarded on the basis of examinations only.

Admission Requirements
Subject to the stipulations of Reg. G.1.3 and G.54, a BEng degree or equivalent qualification is required for admission.

Other programme-specific information
A limited number of appropriate modules from other departments are allowed, i.e. 64 credits.

Examinations and pass requirements
i. The examination in each module for which a student is registered, takes place during the normal examination period after the conclusion of lectures (i.e. October/November or May/June).

ii. A student registered for the honours degree must complete his or her studies within two years (full-time), or within three years (part-time) after first registration for the degree: Provided that the Dean, on recommendation of the relevant head of department, may approve a stipulated limited extension of this period.

iii. A student must obtain at least 50% in an examination for each module where no semester or year mark is required. A module may only be repeated once.

iv. In modules where semester or year marks are awarded, a minimum examination mark of 40% and a final mark of 50% is required.

v. No supplementary or special examinations are granted at postgraduate level.
Pass with Distinction
A student passes with distinction if he or she obtains a weighted average of at least 75% in the first 128 credits for which he or she has registered (excluding modules which were discontinued timeously). The degree is not awarded with distinction if a student fails any one module (excluding modules which were discontinued timeously).

Curriculum: Final Year
Minimum Credits: 128

Core
PSS 700  Research project 700 (compulsory module) - Credits: 32.00
PFZ 780  Financial mine valuation 780 - Credits: 16.00
PHS 781  Slope stability 781 - Credits: 16.00
PKB 711  Airflow and fans 711 - Credits: 16.00
PMZ 780  Advanced design: Mining 780 - Credits: 16.00
POY 783  Open-pit mining 783 - Credits: 16.00
PRX 785  Advanced explosive engineering 785 - Credits: 16.00
PSZ 786  Strata control: Hard-rock mining 786 - Credits: 16.00
PSZ 788  Strata control: Collieries 788 - Credits: 16.00

2.8.2 BScHons Applied Science Mining
12243035
Duration of study: 1 year

Programme Information
The BScHons (Applied Science) degree is conferred by the following academic departments:

- Chemical Engineering
- Civil Engineering
- Industrial and Systems Engineering
- Materials Science and Metallurgical Engineering
- Mechanical and Aeronautical Engineering
- Mining Engineering

Any specific module is offered on the condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant departmental postgraduate brochures must also be consulted.

Admission Requirements
An appropriate bachelor’s degree, a BTech degree or equivalent qualification.

Curriculum: Final Year
Minimum Credits: 128

Core
PSS 700  Research project 700 - Credits: 32.00
PKB 701  Basic mine ventilation engineering 701 - Credits: 16.00
PMY 701  Underground mining methods 701 - Credits: 32.00
PMY 703  Surface-mining 703 - Credits: 16.00
PRX 701  Explosives engineering 701 - Credits: 16.00
PSZ 703  Basic rock mechanics 703 - Credits: 16.00

All the modules above are compulsory for fulfilling the requirement for BScHons (Applied
3. **MEng and MSc programmes in Engineering**

The **MEng** and **MSc** degrees in Engineering are awarded in the following fields of engineering:
- **Duration of study:** 1 year
- **Minimum credits:** 180

The **MEng** and **MSc coursework** degrees in Engineering are awarded in the following fields of engineering:
- **Duration of study:** 2 years
- **Minimum credits:** 180

The programmes are arranged in alphabetical order according to the names of the academic departments.

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### Engineering 2017

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</table>

### 3. Programme Information

Unless the Dean, on recommendation of the relevant head of department, decides otherwise, the master's degree is conferred on the basis of examinations of coursework and a mini-dissertation or a dissertation (including an examination on the mini-dissertation or dissertation).

A mini-dissertation (60 credits) and coursework (120 credits) or a dissertation (180 credits)
credit) are included in the programme. Recognition is not granted for credits acquired during studying for the BEngHons or the BScHons. The curriculum is determined in consultation with the relevant head of department. Any specific module is offered on condition that a minimum number of students are registered for the module, as determined by the head of department and the Dean. Students must consult the relevant head of department in order to compile a meaningful programme, as well as for information on the syllabi of the modules. The various departmental postgraduate brochures should also be consulted.

Admission Requirements
Subject to the stipulations of the General Regulations, Reg. G.1.3 and G.54, a BEngHons degree or equivalent qualification is required for admission to the MEng programmes.

Examinations and pass requirements
The stipulations of the relevant Faculty regulations are applicable. The Dean may, on recommendation of the relevant head of department, exempt a student from the examination on the dissertation. Guidelines for the preparation and examination of mini-dissertations are available from all departments. The average mark awarded by all the examiners is the final mark, with the pass mark being at least 50%.

Research Information
A student must by means of a dissertation or mini-dissertation prove that he or she is capable of planning, instituting and executing a scientific investigation. Unless the Senate, on the recommendation of the supervisor, decides otherwise, a student, before or on submission of a dissertation, must submit proof issued by a recognised academic journal that an article was submitted, to the Head: Student Administration. The draft article should be based on the research that the student has conducted for the dissertation and be approved by the supervisor if the supervisor is not a co-author. The supervisor shall be responsible for ensuring that the paper is taken through all the processes of revision and resubmission, as may be necessary. Conferment of the degree may be made subject to compliance with the stipulations of this regulation.

Pass with Distinction
i. A student who submits a dissertation passes with distinction if an average mark of at least 75% is obtained for the dissertation (and the examination on the dissertation).
ii. A student who completes the master’s degree on grounds of coursework and a mini-dissertation, passes with distinction if a weighted average mark of at least 75% is obtained in the first 128 credits obtained for the degree [first 256 credits in the case of the MEng (Engineering Management), MEng (Project Management), MSc (Engineering Management) or the MSc (Project Management)], provided that 64 of these credits are allocated to the mini-dissertation. However, the degree is not awarded with distinction should a student fail any of these modules (excluding modules which have been timeously discontinued). The degree is also not awarded with distinction if a student obtains less than 70% for the mini-dissertation.
3.4.2 MEng Technology Management (Coursework)
12250254
Duration of study: 2 years

Curriculum: Year 1
Minimum Credits: 120
Core
IKG 881 Technology commercialisation 881 - Credits: 30.00
ILS 802 Literature study 802 - Credits: 30.00
INI 801 Research methodology 801 - Credits: 30.00
ITB 802 Technology management 802 - Credits: 30.00

Curriculum: Final Year
Minimum Credits: 60
Core
IGB 898 Mini-dissertation 898 - Credits: 60.00

3.4.4 MSc Technology Management (Coursework)
12251079
Duration of study: 2 years

Curriculum: Year 1
Minimum Credits: 120
Core
IKG 881 Technology commercialisation 881 - Credits: 30.00
ILS 802 Literature study 802 - Credits: 30.00
INI 801 Research methodology 801 - Credits: 30.00
ITB 802 Technology management 802 - Credits: 30.00

Curriculum: Final Year
Minimum Credits: 60
Core
ISC 898 Mini-dissertation 898 - Credits: 60.00

3.4.5 MEng Engineering Management (Coursework)
12250173
Duration of study: 1 year

Curriculum: Year 1
Minimum Credits: 80
Core
IIB 801 Maintenance management 801 - Credits: 10.00
ILS 801 Literature study 801 - Credits: 10.00
INI 800 Research methodology 800 - Credits: 10.00
IPK 803 Project management 803 - Credits: 10.00
IPP 801 Production and operations management 801 - Credits: 10.00
ISE 801 Systems engineering and management 801 - Credits: 10.00
ITB 801 Technology management 801 - Credits: 10.00
PEM 883 People management 883 - Credits: 10.00
Curriculum: Final Year
Minimum Credits: 100

Mini-dissertation
IGB 898 Mini-dissertation 898 - Credits: 60.00

Core
FBS 830 Financial management 830 - Credits: 10.00
ISM 801 Strategic management 801 - Credits: 10.00

Elective
Select two of the following modules in consultation with the Department of Engineering and Technology Management:
IAM 801 Engineering asset management 801 - Credits: 10.00
IBI 801 Reliability engineering 801 - Credits: 10.00
IIM 801 Marketing management 801 - Credits: 10.00
IIX 801 Engineering logistics 801 - Credits: 10.00
ILB 884 Information management 884 - Credits: 10.00
ILC 803 Legal aspects of project management 803 - Credits: 10.00
IOE 801 New ventures and entrepreneurship 801 - Credits: 10.00
IIM 801 Project quality management 801 - Credits: 10.00
IRI 801 Decision analysis and risk management 801 - Credits: 10.00

3.4.6 MSc Engineering Management (Coursework)
12251077
Duration of study: 1 year

Curriculum: Year 1
Minimum Credits: 80

Core
IIB 801 Maintenance management 801 - Credits: 10.00
ILS 801 Literature study 801 - Credits: 10.00
INI 800 Research methodology 800 - Credits: 10.00
IPK 803 Project management 803 - Credits: 10.00
IPP 801 Production and operations management 801 - Credits: 10.00
ISE 801 Systems engineering and management 801 - Credits: 10.00
ITB 801 Technology management 801 - Credits: 10.00
PEM 883 People management 883 - Credits: 10.00

Curriculum: Final Year
Minimum Credits: 100

Mini-dissertation
ISC 898 Mini-dissertation 898 - Credits: 60.00

Core
FBS 830 Financial management 830 - Credits: 10.00
ISM 801 Strategic management 801 - Credits: 10.00

Elective
Select two of the following modules in consultation with the Department of Engineering and Technology Management:
IAM 801 Engineering asset management 801 - Credits: 10.00
IBI 801 Reliability engineering 801 - Credits: 10.00
IIM 801 Marketing management 801 - Credits: 10.00
IIX 801 Engineering logistics 801 - Credits: 10.00
ILB 884 Information management 884 - Credits: 10.00
ILC 803  Legal aspects of project management 803 - Credits: 10.00
IOE 801  New ventures and entrepreneurship 801 - Credits: 10.00
IQM 801  Project quality management 801 - Credits: 10.00
IRI 801  Decision analysis and risk management 801 - Credits: 10.00

3.4.7  MEng Project Management (Coursework)
12250263  
Duration of study: 1 year

Curriculum: Year 1
Minimum Credits: 80

Core
IHR 801  Project human resource management 801 - Credits: 10.00
ILS 801  Literature study 801 - Credits: 10.00
INI 800  Research methodology 800 - Credits: 10.00
IPF 802  Project financial and cost management 802 - Credits: 10.00
IPJ 801  Project procurement management 801 - Credits: 10.00
IPM 801  Introduction to project management 801 - Credits: 10.00
IRM 801  Project risk management 801 - Credits: 10.00
ISE 802  Project systems engineering 802 - Credits: 10.00

Curriculum: Final Year
Minimum Credits: 100

Mini-dissertation
IGB 898  Mini-dissertation 898 - Credits: 60.00

Core
IMP 801  Project management practice 801 - Credits: 10.00
ISM 804  Strategic project management 804 - Credits: 10.00

Elective
Select two of the following modules in consultation with the Department of Engineering and Technology Management:
IAM 801  Engineering asset management 801 - Credits: 10.00
IBI 801  Reliability engineering 801 - Credits: 10.00
IIM 801  Marketing management 801 - Credits: 10.00
IIX 801  Engineering logistics 801 - Credits: 10.00
ILB 884  Information management 884 - Credits: 10.00
ILC 803  Legal aspects of project management 803 - Credits: 10.00
IOE 801  New ventures and entrepreneurship 801 - Credits: 10.00
IQM 801  Project quality management 801 - Credits: 10.00
KBS 803  Construction management 803 - Credits: 10.00
KBS 804  Construction management 804 - Credits: 10.00
KBS 805  Construction management 805 - Credits: 10.00

3.4.8  MSc Project Management (Coursework)
12251078  
Duration of study: 1 year

Curriculum: Year 1
Minimum Credits: 80

80
Mini-dissertation
ISC 898 Mini-dissertation 898 - Credits: 60.00

Core
IHR 801 Project human resource management 801 - Credits: 10.00
ILS 801 Literature study 801 - Credits: 10.00
INI 800 Research methodology 800 - Credits: 10.00
IPF 802 Project financial and cost management 802 - Credits: 10.00
IPJ 801 Project procurement management 801 - Credits: 10.00
IPM 801 Introduction to project management 801 - Credits: 10.00
IRM 801 Project risk management 801 - Credits: 10.00
ISE 802 Project systems engineering 802 - Credits: 10.00

Curriculum: Final Year
Minimum Credits: 100

Core
IMP 801 Project management practice 801 - Credits: 10.00
ISM 804 Strategic project management 804 - Credits: 10.00

Elective
Select two of the following modules in consultation with the Department of Engineering and Technology Management:
IAM 801 Engineering asset management 801 - Credits: 10.00
IBI 801 Reliability engineering 801 - Credits: 10.00
IIM 801 Marketing management 801 - Credits: 10.00
IIX 801 Engineering logistics 801 - Credits: 10.00
ILB 884 Information management 884 - Credits: 10.00
ILC 803 Legal aspects of project management 803 - Credits: 10.00
IOE 801 New ventures and entrepreneurship 801 - Credits: 10.00
IQM 801 Project quality management 801 - Credits: 10.00
KBS 803 Construction management 803 - Credits: 10.00
KBS 804 Construction management 804 - Credits: 10.00
KBS 805 Construction management 805 - Credits: 10.00

4. PhD programmes
Duration of study: 2 years

Other programme-specific information
Also consult the General Regulations. G.42 tot G.54.

a. Subject to the stipulations of the General Regulations, no candidate is admitted to doctoral studies unless such a candidate holds a master's degree in Engineering or an equivalent master's degree.

b. Unless otherwise decided by the Dean, on the recommendation of the supervisor, the PhD (Engineering) degree is awarded on the basis of a thesis and an examination on the thesis.

c. Unless Senate, on the recommendation of the supervisor, decides otherwise, a student, before or on submission of a thesis, must submit proof of submission of an article from/issued by an accredited journal, to the Head: Student Administration. The submitted article should be based on the research that the student has conducted for the thesis and be approved by the supervisor if the supervisor is not a co-author. The supervisor shall be responsible for ensuring that the paper is taken through all the processes of revision and resubmission, as may be necessary. Conferment of the degree may be made subject to compliance with the stipulations of this regulation.
d. The student must provide proof by means of his work, thesis and examination of advanced original research and/or creative work which makes a real and substantial contribution to the knowledge of engineering science and/or practice.

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<tr>
<th>4.</th>
<th>PhD Programmes</th>
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ALPHABETICAL LIST OF MODULES IN THE SCHOOL OF ENGINEERING AND THE GRADUATE SCHOOL OF TECHNOLOGY MANAGEMENT

# = Concurrent registration
() = Examination admission
dpw = discussions per week
GS = combined (final) mark (semester/year mark plus examination mark) of at least 40% – 49%
hpw = hours per week
LP = Lecturer’s permission
lpw = lectures per week
ppw = practicals per week
spw = seminars per week
TDH = Permission by head of department
tpw = tutorials per week
opw = other per week

BAN 313 Industrial analysis 313
Academic organisation: Industrial and Systems Engineering
Prerequisite: BES 220
Contact time: 1 tpw 2 lpw
Period of presentation: Semester 1
Language of tuition: English Credits: 8
Module content:
Mathematical statistics provides the basis for a number of important applications in the engineering environment. This module provides an introduction to the most important of these applications and will include the following syllabus themes: Monte Carlo simulation, decision analysis, forecasting and data-dependent modelling.

BAN 780 Industrial analysis 780
Academic organisation: Industrial and Systems Engineering
Prerequisite: Not for Industrial Engineering students
Contact time: 24 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16
Module content:
• Monte Carlo Simulation
• Continuous Simulation
• System Dynamics
• Multi-objective Decision-making
• Operations Research
• Decision Analysis
• Discrete Simulation

BAO 780 Advanced aspects of operations research 780
Academic organisation: Industrial and Systems Engineering
Contact time: 24 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16
Module content:
Decision makers are frequently faced with complex problem environments. The module introduces two advanced topics in the field of Operations Research that can assist in the development of more relevant decision support models. The first topic deals with multi objectivity and introduces a variety of interventions to incorporate the competing
objectives into mathematical programming models. Secondly, the topic of Data Envelopment Analysis (DEA) is introduced, a non-parametric method used to empirically measure the productive efficiency of decision-making units. This linear programming methodology allows the decision maker to measure the productivity in complex environments with multiple inputs and outputs; uncover often overlooked relationships between inputs and outputs; and analyse and quantify the inefficiencies of every unit evaluated.

**BAR 780 Solution algorithms in operations research 780**
**Academic organisation:** Industrial and Systems Engineering  
**Prerequisite:** BAN 313 or BAN 780  
**Contact time:** 48 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 32

**Module content:**
When developing decision-support models using optimisation, the computational burden is often so great that exact optimal solutions are not attainable, or not efficiently found, especially in combinatorial and discrete optimisation problems. Often approximate solutions are adequate and can provide superior solutions to the current state-of-practice decision approaches. The module introduces a selection of heuristics and metaheuristics applied to a variety of problems frequently faced by Industrial Engineers. The module also introduces a methodology to test and validate heuristics to ensure robust and reliable application.

**BBA 781 Enterprise engineering and research methods 781**
**Academic organisation:** Industrial and Systems Engineering  
**Contact time:** 48 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32

**Module content:**
Enterprise Engineering can be defined as the body of knowledge, principles, and practices to design an enterprise. Due to their complexity and the continuously changing environment, enterprises need new approaches, tools and techniques to deliver innovative products and services to new markets in competitive environments. This module offers an introduction to the engineering design process applied to the enterprise as a system, and present existing approaches for designing, aligning and governing the enterprise. Within the design paradigm, the module also offers research methods (e.g. design research and action research) that are relevant for doing research within the enterprise engineering discipline.

The module covers:
- Background on systems thinking
- Systems design and systems engineering
- Prominent approaches for creating an enterprise engineering capability (e.g. Zachman, The Open Group, Dietz/Hoogervorst).
- Mechanisms and practices associated with different phases of enterprise design (e.g. enterprise modelling, languages, road maps, maturity assessment etc.)
- Research methods and techniques to validate and extend the EE knowledge base
- Case studies
- Change management.

**BCI 780 Supply chain information and decision technology 780**
**Academic organisation:** Industrial and Systems Engineering  
**Contact time:** 24 contact hours per semester
Period of presentation: Semester 1 or Semester 2  
Language of tuition: English  
Credits: 16

Module content:
Information technology is an important enabler of effective supply chain management, typically spanning the extended value chain from suppliers to customers. The timeliness and availability of relevant information are critical when applying supply chain strategies that increase service levels of and reduce cost and lead times. Value-added IT-based services are increasingly used to differentiate and develop relationships with customers. The objective of the course is to develop a sound understanding of components and priorities IT investment to enable supply chain integration and efficiency, the impact of business process change on IT implementation and selection of decision support systems.

- The Value of Information
- Leveraging Financial Information
- Advanced Supply Chain Planning and Execution
- Decision Support Systems
- IT Capabilities for Supply Chain Excellence
- Enterprise Resource Planning Systems
- Advanced Planning and Scheduling Systems
- Identification Technology
- Integrating Supply Chain IT

BCS 780 Industrial and systems engineering research 780 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or Semester 2

Language of tuition: English  
Credits: 32

Module content:
The module affords an individual student the opportunity of studying a designated area of coherent knowledge under the tutorship of a senior staff member of the Department of Industrial and Systems Engineering. Eligibility, topic and scope of the intended project must be determined in consultation with the proposed supervisor.

BDE 780 Design and analysis of experiments 780

Academic organisation: Industrial and Systems Engineering

Contact time: 24 contact hours per semester

Period of presentation: Semester 1 or Semester 2

Language of tuition: English  
Credits: 16

Module content:
The design of an experiment may be defined as ‘the logical construction of an experiment in which the degree of uncertainty with which the inferences are drawn may be well defined’. The module deals with the following:

- Principles of experimental design (Randomisation, Replication and Blocking (local control))
- One-Factor-Two-level Factorial Designs
- One-Factor-Multi-level Factorial Designs
- Completely Randomised Design (CRD) and introduction to ANOVA
- Randomised Complete Block Design (RBD)
- Latin Square Design (LSD)
- Balanced Incomplete Block Design (BIBD)
- Factorial Experiments (2nd and 3rd factorial experiments)
- Blocking and Confounding in Factorial designs
- Overview of Factorial Designs
BEE 780 Inventory modelling 780
Academic organisation: Industrial and Systems Engineering
Contact time: 24 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 16
Module content:
• Theory of Inventory Systems:
  Inventory models and modelling including time and certainty complexities, linear
  and non-linear systems and feedback systems
• Review of inventory models:
  Types and representations (classic, shortage, capacity constraint, time value of
  money, deterioration, time varying, stochastic inputs, imperfect quality, integrated
  scheduling and lot sizing models, service systems and retrial queues)
• Review of important inventory papers, their approaches and their foci:
• Modelling and Solution techniques:
  Characterisation and assumptions
  Mathematical Modelling, Mathematical Programming, Heuristics, Simulation
  Models, Control Theory and other approaches
• State of the art of modelling:
  Current challenges and research trends
• Technological solutions of inventory modelling and management:
  Algorithms and software, integration to MRP, ERP and scheduling modules,
  integration to WMS modules, and demonstrations

BES 220 Engineering statistics 220
Academic organisation: Industrial and Systems Engineering
Prerequisites: WTW 158 GS, WTW 164 GS
Contact time: 1 tpw 2 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng
Credits: 8
Module content:
Engineering systems are often subjected to variation, uncertainty and incomplete
information. Mathematical statistics provides the basis for effectively handling and
quantifying the effect of these factors. This module provides an introduction to the
concepts of mathematical statistics and will include the following syllabus themes: data
analysis, probability theory, stochastic modelling, statistical inference and regression
analysis.

BES 780 Applied engineering statistics 780
Academic organisation: Industrial and Systems Engineering
Contact time: 24 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 16
Module content:
This module presents an applied approach to solve real-world engineering problems. The premise of the course is that data analysis, and thus, applied statistics, is an inseparable part of conducting research and solving engineering problems. The module presents the elements of different types of statistical studies as they relate to different industrial settings. The aim of the module is to promote inductive reasoning through the gathering, analysing and interpreting of diverse types of observational data. The outcome of the module is an engineer equipped to select and apply statistical methods appropriate to an industrial setting. The course covers the following topics:

- Contextualisation: Different types of industrial processes and research settings, related types of statistical studies and a framework for understanding and applying statistics
- Principles of probabilistic and rational data gathering
- The use of common and specialised probability distributions (such as the Gamma, Exponential and Weibull distributions) in solving real-life problems, conducting scientific research and analysing stochastic and deterministic processes
- Data transformations: When and how to transform data
- Bridging the gap between technology and statistical analysis: The use of EXCEL in resolving basic and advanced statistical problems

**BFB 320 Facilities planning 320**
**Academic organisation:** Industrial and Systems Engineering  
**Contact time:** 1 ppw 2 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 8

**Module content:**
This module introduces the principles, approaches, methods, techniques and tools to systematically determine facility requirements, determine the required space of and relationships between activities, develop and evaluate alternative plans and layouts and present the results. Aspects such as facilities location, manufacturing and service process design, capacity planning, materials handling, personnel facilities, storage and warehousing are also addressed. A structured facility design project forms an integral part of the course.

**BGC 410 Quality assurance 410**  
**Academic organisation:** Industrial and Systems Engineering  
**Contact time:** 1 tpw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16

**Module content:**
Introduction to quality and quality management systems. Statistical process control. Acceptance control.

**BGH 780 Quality management 780**
**Academic organisation:** Industrial and Systems Engineering  
**Contact time:** 24 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16

**Module content:**
Professionally, engineers are confronted with issues related to product quality and performance or organisational excellence. The intention of this course is to provide an overview of the domain of modern quality management and to equip the student with theory, methodologies and tools and techniques to improve and achieve product quality
and performance excellence.
The course covers the following topics;
• Contextualisation: The History, Guru’s, Principles, Industrial setting and the Domain of Quality Management
• Practices of improving and achieving product quality: Role in Industrial Engineering, On-line and Off-line Quality Control Practices
• Frameworks of improving organisational excellence: National Quality Awards, ISO 9000 and other frameworks
• Practices of improving performance excellence: Quality and Competitive advantage, Customer and Supplier relationships, People Empowerment and Motivation, Quality Leadership and Organisational change.

BHM 780 Probability models 780
Academic organisation: Industrial and Systems Engineering
Contact time: 24 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16
Module content:
The objective of the module is that students be exposed to probability theory, learn the ability to follow fairly involved theoretical reasoning, continue to learn how to reason mathematically, and solve problems of a more practical nature. It covers:
• Probability theory: Random variables and random vectors, Sequence of random variables, Transformation of Probability distributions
• Stochastic Processes: Examples of stochastic processes; various types of stochastic processes
• Poisson Processes: Homogeneous and non-homogeneous stochastic processes with examples
• Renewal Processes: Renewal functions; ordinary and delayed renewal processes; Regenerative stochastic processes
• Discrete-time Markov chains: continuous time Markov chains with focus on examples in Reliability, queuing and inventory models.

BID 320 Information systems design 320
Academic organisation: Industrial and Systems Engineering
Contact time: 1 tpw 2 ppw 3 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 16
Module content:
Systems development planning, system requirement analysis, different approaches towards structured analysis and design of systems, process design, database design and normalization, object-oriented design and modelling, information system application building and testing.

BIE 420 Engineering economics 420
Academic organisation: Industrial and Systems Engineering
Contact time: 3 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng Credits: 8
Module content:
Money-time relationships and equivalence (interest formulae, effective interest rate, bonds and loans). Bases for comparison of alternatives (present worth, annual worth, Internal rate of return, external rate of return, investment balance diagrams, Decision making among alternatives (useful lives equal to study period, useful lives different

BIR 890 Dissertation: Industrial engineering 890
Academic organisation: Industrial and Systems Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng  Credits: 180

BIR 891 Dissertation 891
Academic organisation: Industrial and Systems Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng  Credits: 180

BIR 990 Thesis: Industrial engineering 990
Academic organisation: Industrial and Systems Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng  Credits: 360

BIS 780 Information systems 780
Academic organisation: Industrial and Systems Engineering
Contact time: 24 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English  Credits: 16

Module content:
To introduce the student with a background in transactional application software development to a variety of aspects in the wider field of information technology. Emphasis is on the functional design of Business Intelligence systems from an Industrial Engineering perspective. The aim is to enable the student to appreciate the scope of management challenges in the integrated environment of business processes, transactional application software, data, IT infrastructure and telecommunications, data warehousing, and the necessary management information needed at various levels in an organisation. It covers:

- Technology trends
- Context diagram of application software portfolio
- Review of typical transactional information systems
- Role of Business Intelligence and data warehousing
- Business dimensional lifecycle
- Business requirement definition
- Basic elements of the data warehouse
- Extraction, Transformation and Loading processes
- Dimensional modelling (star schema)
- Metadata
- Information delivery

BIT 990 Thesis: Industrial systems 990
Academic organisation: Industrial and Systems Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng  Credits: 360

BJJ 210 Professional and technical communication 210
Academic organisation: Industrial and Systems Engineering
Contact time: 2 lpw 2 opw
Period of presentation: Semester 1
Language of tuition: English  
Credits: 8

Module content:
Communicate effectively, both orally and in writing, with engineering audiences and the community at large. Written communication as evidenced by: uses appropriate structure, use of modern or electronic communication methods; style and language for purpose and audience; uses effective graphical support; applies methods of providing information for use by others involved in engineering activity; meets the requirements of the target audience. Effective oral communication as evidenced by appropriate structure, style and language; appropriate visual materials; delivers fluently; meets the requirements of the intended audience. Audiences range from engineering peers, management and lay persons, using appropriate academic or professional discourse. Typed reports range from short (300-1 000 word plus tables diagrams) to long (10 000-15 000 words plus tables, diagrams, references and appendices), covering material at exit level. Methods of providing information include the conventional methods of the discipline, for example engineering drawings, as well as subject-specific methods.

BLC 780 Lean supply chain strategies and systems 780  
Academic organisation: Industrial and Systems Engineering  
Contact time: 24 contact hours per semester  
Period of presentation: Semester 1 or Semester 2  
Language of tuition: English  
Credits: 16

Module content:
Supply chain executives need to contribute and support long term strategic objectives by providing a competitive edge through an aligned supply chain strategy. The course addresses the impact of lean principles in supply chain management and practical approach to implementing lean thinking and demand driven supply chains. The course provides a framework for the strategic supply chain decisions, both in designing and managing an efficient extended supply chain. The latest innovations, trends and challenges in agile supply chain strategies and systems are reviewed. Team leadership skills are developed through practical applications, approaches and best practices of lean supply chain design and management. Supply chain leadership perspectives will be provided by executives and managers from industry and team-based simulation games.

Course outline:
- Fundamentals of lean management
- Lean Thinking and Supply Chain (SC) management
- Customer Value
- Network design strategies
- Supply Chain Integration and barriers to Integration
- SC performance measurement
- Extended Value Chain and Value Stream Mapping
- Eliminating Waste in the Supply Chain
- Applying Lean Principles to Supply Chain Operations
- Inventory positioning approaches
- Operational Executive Problems

A3 Performance Management

BLK 320 Industrial logistics 320  
Academic organisation: Industrial and Systems Engineering  
Prerequisite: (BOB 310)  
Contact time: 2 tpw 4 lpw  
Period of presentation: Semester 2  
Language of tuition: Both Afr and Eng  
Credits: 16
Module content:

BLK 781 Supply chain processes 781
Academic organisation: Industrial and Systems Engineering
Contact time: 24 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English  Credits: 16

Module content:
key objective of supply chain management is to develop competiveness and achieve a market advantage through the implementation of cross-functional processes as the mechanism to coordinate internal and external activities. The course aims to create an understanding of the importance of integrating key supply chain business processes and to develop the ability to analyse and implement such processes across functional and corporate silos. Standardised process definitions and practices, including strategic and operational sub-processes and key performance measurements, are considered.

Course outline:
• Customer Relationship Management Process
• Supplier Relationship Management Process
• Customer Service Management Process
• Demand Management Process
• Order fulfilment Process
• Manufacturing Flow Management (Planning and Control) Process
• Product Development and Commercialisation Process
• Returns Management Process
• Assessment of Supply Chain Management (SCM) Processes
• Implementing and Sustaining SCM Processes
• Supply Chain Mapping Approaches
• Supply Chain Performance Measurement

BMK 781 Process optimisation 781
Academic organisation: Industrial and Systems Engineering
Contact time: 24 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English  Credits: 16

Module content:
Process optimisation is an engineering discipline which focuses on the tools and techniques used specifically for business process analysis, design, and optimisation. As physics determines the physical behaviour of tangibles, process physics forms the foundation of business process behaviour. Traditionally, operations research techniques are used by Industrial Engineers to optimise business processes, process optimisation provides a more focused approach using techniques such as Social Network Analysis, System Dynamics, image profiling and process mining to uncover analytical models. The outcome of this course is to enable the student to create an integrated, analytical business process behaviour profile. This supports the analysis, design and optimisation of business processes in a Business Engineering lifecycle. The following topics are covered in the course:
• Standard Process Physics principles, facts and models.
• Process Intelligence
• Adaptive process control and SMART processes
• Robustness and complexity analysis
• Process mining
• Social Network Analysis

Process optimisation requires an understanding of operations research within the business engineer framework. This course requires a full understanding of undergraduate Industrial Engineering modules as well as a postgraduate understanding of resource optimisation and enterprise architecture.

BOB 310 Operational management 310
Academic organisation: Industrial and Systems Engineering
Contact time: 2 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: English Credits: 16
Module content:

BON 410 Operational research 410
Academic organisation: Industrial and Systems Engineering
Prerequisite: (BES 220), (BOZ 312)
Contact time: 1 tpw 3 lpw
Period of presentation: Semester 1
Language of tuition: English Credits: 16
Module content:
Review of basic probability, Markov chain models, Markov decision models. Queuing systems: M/M/1 queues (both finite and infinite capacity), etc.; deterministic and stochastic inventory models. Competitive games: pure and mixed strategies, optimum strategy, two-person zero-sum games, graphical methods and applications, LP methods for games.

BOZ 312 Operational research 312
Academic organisation: Industrial and Systems Engineering
Contact time: 1 tpw 3 lpw
Period of presentation: Semester 1
Language of tuition: English Credits: 16
Module content:
Introduction to Operations Research, and more specifically the branch of optimisation and its application to industrial problems. In the module the topics of linear and integer linear programming are introduced. The focus is on identifying and scoping appropriate problems, the subsequent formulation of problems, solution algorithms, and post-optimisation sensitivity analysis. Students are exposed to solving problems using optimisation software.
BOZ 780 Operations research 780  
**Academic organisation:** Industrial and Systems Engineering  
**Contact time:** 24 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
Building on undergraduate modules in Operations Research, the module aims to extend the mathematical programming and optimisation capabilities by introducing uncertainty. Many decision makers are confronted with complex environments in which data is not known with certainty, or in which the decision constraints are uncertain. For cases where one knows the shape, or can assume that the uncertainty follows a known probabilistic distribution, stochastic programming can be used. In the module both chance-constrained programming and fixed recourse are introduced. Fuzzy optimisation is introduced for cases where the shape and/or distribution of the uncertainty are not known. The module also addresses the uncertainty when a decision maker is confronted with multiple, competing objectives.

BPJ 410 Project 410  
**Academic organisation:** Industrial and Systems Engineering  
**Prerequisite:** Finalists only  
**Contact time:** 1 opw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Choice of project topic. Appointment of project leader. Literature study, analysis and creation of alternatives.

BPJ 420 Project 420  
**Academic organisation:** Industrial and Systems Engineering  
**Prerequisite:** BPJ 410  
**Contact time:** 2 opw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 24  
**Module content:**  
Narrowing of topic choice. Detailed solution of chosen alternative. Writing of final project report and presentation of project.

BPY 310 Practical training 310  
**Academic organisation:** Industrial and Systems Engineering  
**Contact time:** 1 opw  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  
Attendance module only  
During or at the end of the second year of study, students in industrial engineering undergo at least six weeks of prescribed practical training in the industry. A satisfactory report on the practical training must be submitted to the Faculty Administration within one week of registration. In exceptional circumstances the prescribed minimum period can be reduced, as approved by the chairman of the School of Engineering.

BPY 410 Practical training 410  
**Academic organisation:** Industrial and Systems Engineering  
**Contact time:** 1 opw  
**Period of presentation:** Semester 1
Language of tuition: Both Afr and Eng  Credits: 16
Module content: *Attendance module only
During or at the end of the third year of study, students in industrial engineering undergo at least six weeks of prescribed practical training in the industry. A satisfactory report on the practical training must be submitted to the department within one week of registration. In exceptional circumstances the prescribed minimum period can be reduced, as approved by the chairman of the School of Engineering.

BPZ 220 Productivity 220
Academic organisation: Industrial and Systems Engineering
Contact time: 1 tpw 2 ppw 3 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng  Credits: 16
Module content:

BPZ 421 Business engineering 421
Academic organisation: Industrial and Systems Engineering
Contact time: 2 tpw 4 lpw
Period of presentation: Semester 2
Language of tuition: English  Credits: 16
Module content:
Integration of engineering functions; strategic planning; organisational structures; business management; systems engineering; work-flow management; process modelling; business architecture; change management and motivation; marketing management and industry exposure. Business management game project.

BPZ 782 Manufacturing planning and control systems 782
Academic organisation: Industrial and Systems Engineering
Prerequisite: BOB 310
Contact time: 24 Contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English  Credits: 32
Module content
Review of MPC, Agile Manufacturing Processes, Models of MPC.
Section 1: Review of MPC Theories and Framework
Section 2: Research Framework for Problems in Manufacturing Systems
  • Mathematical Model based Problems and their techniques
  • Estimation and Hypothesis based Problems and their techniques
Section 3: Introduction to MPC Problems and sample Models
  • Forecasting models
  • Aggregate planning models
  • Lot sizing and disaggregation models
  • Finite Scheduling models
  • Lean Manufacturing Models
  • Basic Distribution and Replenishment Models
  • Basic Supply Chain Structural Analysis and Performance Models
Section 4: Agile Panning Problems and Techniques
Organisations are complex systems which consist of people, processes, customers, resources and regulatory environments. Business Engineering (BE) is a discipline which uses an engineering approach towards introducing planned business change into the organisation. This includes formal analysis, design, implementation and maintenance of the holistic business system; requiring a deep understanding and knowledge of the interaction and balance of complex business system elements.

The outcome of the course is to enable the student to understand the art and science of engineering complex business systems. The following topics are covered in the course:

- BE principles for design, implementation and optimisation of complex business systems
- BE programme process which governs the implementation of holistic business changes
- BE programme and project structures
- BE Tools and techniques used throughout the BE lifecycle for engineering modelling and optimisation.
- Business
- Models and innovation approaches
- Integrated Business planning
- Business Process reference models for strategic, tactical, core and support processes.

Business engineering is the ultimate pinnacle of industrial engineering competency – being able to construct business systems serving complicated organisational value propositions. The course requires a full understanding of undergraduate Industrial Engineering modules as well as a postgraduate understanding of resource optimisation, enterprise architecture, and supply chain engineering.
Engineering Economics
Decision making in an engineering environment. Allocation of cost. Money-time relationships (discreet interest formulae, tables, financial calculator, Excel). Bases for comparison of alternatives (present worth, annual worth,). Decision making among alternatives before and after tax (useful lives equal to study period, useful lives different among alternatives).

BSS 410 Systems engineering 410
Academic organisation: Industrial and Systems Engineering
Contact time: 1 tpw 3 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 16
Module content:
A company's ability to remain competitive hinges increasingly on its ability to develop successful products. In practice this is often determined by how well the company performs systems engineering. Applying the principles of systems engineering allows designers to understand the big picture, i.e. how a product needs to perform technically as well as within its application domain, e.g. environmentally, human interfaces, and so on. This module equips the student with the relevant tools and process understanding to successfully apply systems engineering to product development. Some of these tools and processes include specification practices, requirements engineering, systems engineering management and verification and validation processes.

BTH 780 Reliability engineering 780
Academic organisation: Industrial and Systems Engineering
Contact time: 24 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16
Module content:
To make students conversant with the concepts, tools and techniques of reliability engineering.
Capita selecta from:
- Introduction to Reliability Engineering
- Reliability Mathematics
- Probability Plotting
- Reliability Prediction for Design
- Reliability Testing
- Reliability Growth
- Maintainability
- Reliability Management

BUY 321 Simulation modelling 321
Academic organisation: Industrial and Systems Engineering
Prerequisite: (BAN 313)
Contact time: 2 tpw 4 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 16
Module content:
Introduction to simulation as technique. Simulation methodology. Formulation of problem situations by means of simulation models with the emphasis on discrete models. Input and output analysis. Introduction to simulation software.

BUY 780 Simulation modelling 780
Academic organisation: Industrial and Systems Engineering
Contact time: 24 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 32
Module content:
In recent years the boundaries between different simulation paradigms such as discrete event simulation, system dynamics and agent-based models have become less distinct. Improvements in computational efficiency also allow much richer and complex models to be built. This course introduces agent-based models (ABM) as a class of computational models that deal with autonomous agents and their interactions with other agents, and their surrounding environments. Course content covers basic theoretical foundations of ABM and then focuses on a few specific application areas where ABM is used for decision-making: pedestrian and transport models; production and logistics; as well as biology.

BVK 780 Supply chain design 780
Academic organisation: Industrial and Systems Engineering
Contact time: 2 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 16
Module content:
Strategic design of supply chain networks, inventory management and supply chain integration. Framework for strategic alliances and third party logistics. Analysis and application of alternative supply chain reference models as the basis for modelling, analysis and improvement. Course outline:
• Supply Chain Network Design
• Strategic Management of Inventory
• Supply Chain Integration
• Strategic Alliances
• Coordinated Product and Supply Chain Design
• Supply Chain Modelling (SCOR, VRM)

CAM 780 Air quality control 780
Academic organisation: Chemical Engineering
Contact time: 32 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 32
Module content:

CAM 787 Air quality control 787
Academic organisation: Chemical Engineering
Contact time: 32 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 32
Module content:
adsorption and absorption equipment.

**CBI 310 Biochemical engineering 310**

**Academic organisation:** Chemical Engineering  
**Prerequisite:** (CIR 211), (CHM 215)  
**Contact time:** 3 tpw 4 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16

**Module content:**
Characterisation and taxonomy of biological material. Biochemistry and the chemistry of life. Biological growth requirements, metabolism, growth kinetics and product formation. Enzyme chemistry and kinetics, basic stoichiometry of biological reactions as well as mass - and energy balances for these processes using a chemical engineering approach. Biological reactor operation and downstream processing.

**CBO 700 Multivariable control system design 700**

**Academic organisation:** Chemical Engineering  
**Contact time:** 40 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 32

**Module content:**
Design of multivariable controllers using various design techniques. Application of criteria for achieving satisfactory performance, reduction of interaction, maintaining stability and obtaining robust controllers. Design techniques: Sequential loop closure, use of interaction analysis and the RGA; Frequency domain techniques: Inverse Nyquist Array (INA)-, Characteristic Loci (C.L) – and LACEY-techniques; Model-based approaches: Model-Predictive Control (MPC), Internal Model Control (IMC) and Dynamic Matrix Control (DMC); Optimal Controller Design Techniques: LQG, µ-synthesis and H Neural networks and Fuzzy Logic Controllers.

**CBP 732 Bioprocessing 732**

**Academic organisation:** Chemical Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32

**Module content:**
Description of industrial biotechnology in a process engineering environment. Focus on specific applications in the mining, agricultural, paper and pulp, medical, pharmaceutical, veterinary, brewing and food industries. Principles including implications of bio-prospecting, bio-safety, inoculum production, aseptic growth, quality control and product formulation as applicable to bio-processes. Fermentation with various microbial groups, bio-leaching, gene transfer, solid-substrate fermentation, enzymatic catalysis and immunology. Bioreactors, batch and continuous processing, Bio-remediation.

**CBT 700 Multivariable control system theory 700**

**Academic organisation:** Chemical Engineering  
**Contact time:** 48 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32

**Module content:**
Overview of single loop feedback principles; Matrices and matrix operations; Singular values; State-space description of systems; Extension to multivariable systems; Properties of multivariable systems: Interaction, Stability, Performance, Robustness;
Uncertainty. Norms and relationships between single and multiple loop criteria. Criteria for control system specification.

**CCT 990 Thesis: Chemical technology 990**
**Academic organisation:** Chemical Engineering
**Period of presentation:** Year
**Language of tuition:** English
**Credits:** 360

**CEM 780 Principles of environmental engineering 780**
**Academic organisation:** Chemical Engineering
**Contact time:** 32 contact hours per semester
**Period of presentation:** Semester 1
**Language of tuition:** English
**Credits:** 32

**Module content:**
Engineering principles for environmental preservation and management, pollution control, life-cycle assessment, interactions in the macro and micro-environments, global and ecological systems, social-economic factors in environmental systems, predictive models for the current and future environment, environmental engineering as the driver of economic systems. Focus on design aspects.

**CEM 787 Principles of environmental engineering 787**
**Academic organisation:** Chemical Engineering
**Contact time:** 32 contact hours per semester
**Period of presentation:** Semester 1 or Semester 2
**Language of tuition:** English
**Credits:** 32

**Module content:**
Engineering principles for environmental preservation and management, pollution control, life-cycle assessment, interactions in the macro and micro-environments, global and ecological systems, social-economic factors in environmental systems, predictive models for the current and future environment, environmental engineering as the driver of economic systems.

**CFT 732 Fluoro-materials science research and technology 732**
**Academic organisation:** Chemical Engineering
**Contact time:** 2 lpw
**Period of presentation:** Semester 2
**Language of tuition:** English
**Credits:** 32

**CIM 210 Chemical engineering materials 210**
**Academic organisation:** Chemical Engineering
**Prerequisite:** CHM 181
**Contact time:** 2 lpw 2 tpw
**Period of Presentation:** Semester 1
**Language of tuition:** English
**Credits:** 8

**Module content:**
Introduction to the synthesis, processing, structure, physical properties, and technical performance of important engineering materials: metals, ceramics, polymers and composites. Structural, mechanical, thermodynamic, and design related issues important to chemical engineering applications. Materials specification with emphasis on the corrosion of metals and life time estimation for polymer components.

**CIO 320 Chemical engineering design 320**
**Academic organisation:** Chemical Engineering
**Prerequisite:** (CTD 223), SWK 210, (COP 311)
**Contact time:** 3 tpw 4 lpw
Period of presentation: Semester 2  
Language of tuition: English  
Credits: 16  
Module content:  

CIP 732 Process integration 732  
Academic organisation: Chemical Engineering  
Contact time: 44 contact hours per semester  
Period of presentation: Semester 1  
Language of tuition: English  
Credits: 32  
Module content:  
Heat integration: targeting for minimum use of utilities, selection and optimal placing of utilities, role of minimum temperature difference, design for maximum energy recovery, placement of heat engines and heat pumps, capital-energy trade-offs, heat integration of reactors, heat integration of distillation columns, total site analysis; Mass integration: modelling of mass exchange units, synthesis of mass exchanger networks, mathematical optimization techniques for mass integration, wastewater minimization using the WaterPinch; Batch process integration: types and operational philosophies of batch processes, heat integration using time average models, wastewater minimisation in batch processes, scheduling techniques of batch processes, design and synthesis of batch processes.

CIR 113 Chemical engineering 113  
Academic organisation: Chemical Engineering  
Contact time: 2 lpw 2 tpw  
Period of presentation: Semester 1  
Language of tuition: English  
Credits: 8  
Module content:  

CIR 123 Chemical engineering 123  
Academic organisation: Chemical Engineering  
Prerequisite: CIR 113, CHM 171 GS  
Contact time: 2 lpw 2 tpw  
Period of presentation: Semester 2  
Language of tuition: English  
Credits: 8  
Module content:  
Chemical reaction and stoichiometry, excess reactant, conversion, yield, selectivity. Material balances with recycle streams, bypass streams and purge streams. Gases, vapours and liquids: ideal gas law, SG and density of gases, Nm³. Material balances where gases are involved. Fuels and combustion: coal analysis, combustion calculations.

CIR 211 Chemical engineering 211
Academic organisation: Chemical Engineering
Prerequisites: CIR 123
Contact time: 3 lpw 3 tpw
Period of Presentation: English
Language of tuition: Semester 1 Credits: 12
Module content:

CIR 310 Chemical engineering 310
Academic organisation: Chemical Engineering
Prerequisite: (CTD 223), CHM 215
Contact time: 2 lpw 2 tpw
Period of Presentation: Semester 1
Language: English Credits: 8
Module content:

CIR 702 Chemical engineering 702
Academic organisation: Chemical Engineering
Contact time: 8 contact hours per semester
Period of presentation: Year
Language of tuition: English Credits: 32

CIR 707 Chemical engineering 707
Academic organisation: Chemical Engineering
Contact time: 8 contact hours per semester
Period of presentation: Year
Language of tuition: English Credits: 32

CIR 787 Chemical Engineering 787
Academic organisation: Chemical Engineering
Contact time: 10 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16

CIR 890 Dissertation: Chemical engineering 890
Academic organisation: Chemical Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng Credits: 180
CIR 990 Thesis: Chemical engineering 990
Academic organisation: Chemical Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng Credits: 360

CJJ 310 Professional and technical communication 310
Academic organisation: Chemical Engineering
Prerequisite: CIR 123
Contact time: 2 lpw
Period of presentation: Semester 1
Language of tuition: English Credits: 8
Module content:
Effective communication with engineering and technical audiences, as well as with the community at large, is taught. The emphasis is on written documentation. Formal communication is characterised by: the use of appropriate language and style; effective structuring of information; the use of modern electronic communication technologies, with emphasis on word processing, spreadsheets, appropriate email protocols, effective use of graphic information, effective and correct presentation of numerical data, correct referencing methods, seamless inclusion of mathematics expressions, tables, diagrams and appendices in written work; appropriate methods for levelling communication to the requirements of the target audience.

CKN 321 Kinetics 321
Academic organisation: Chemical Engineering
Prerequisite: (CTD 223)
Contact time: 3 tpw 4 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 16
Module content:
Batch reactors; basic reaction kinetics; fitting of experimental reaction data; flow reactor basics.

CKO 732 Environmental nanomaterials 732
Academic organisation: Chemical Engineering
Contact time: 32 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English Credits: 32
Module content:
Introduction to nanotechnology, industrial production of nanomaterials, physico-chemical properties of nanomaterials, identification of nanomaterials sources (point vs diffuse sources) to aquatic systems. Fate, behaviour and transport of nanomaterials in different environmental media (freshwater, sediments, wastewater, and soil). Fractal theory and transformation pathways of nanomaterials: chemical, biological, physical and interactions with macromolecules transformations. Nanocotoxicology: concept of toxicity within nanomaterials regime, nanomaterials toxicity tests (acute vs. chronic toxicity), mechanisms of nanomaterials toxicity, biocompatibility of nanomaterials, bioaccumulation and persistence. Risk assessment paradigm: Hazard identification (production volumes, material flows, nanowastes generation, bioaccumulation, long-range transport, and persistence), hazard characterization (in vitro vs. in vivo studies, adverse outcome pathways), exposure assessment (life cycle assessment and environmental uptake), risk assessment, and risk management (regulation, nanowastes and by-products management protocols). Sustainable nanotechnology paradigm: safety-by-design concept, risk modelling and predictions.
CLB 321 Laboratory 321
Academic organisation: Chemical Engineering
Prerequisite: CJJ 210/CJJ 310, CHM 226, CPN 321#, CKN 321#, (CMO 320/310), CIO 310/320#
Contact time: 2 lpw 8 ppw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng
Credits: 16
Module content:

CML 732 Model-based control laboratory 732
Academic organisation: Chemical Engineering
Contact time: 12 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 32
Module content:
Development of models for complex processes using conservation laws, equilibrium relationships and transport equations. Numerical modelling. Use of commercial software packages. Process identification techniques. Implementation of advanced, model-based, controller designs on experimental test rigs taking into account the practical role of controllers, computing equipment, software, measuring instruments, final control elements, noise, etc. in the successful operation of a control system.

CMO 310 Mass transfer 310
Academic organisation: Chemical Engineering
Prerequisite: (CTD 223), COP 311#
Contact time: 3 tpw 4 lpw
Period of presentation: Semester 1
Language of tuition: English
Credits: 16
Module content:

CMS 732 Carbon materials science research and technology 732
Academic organisation: Chemical Engineering
Contact time: 10 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 32
Module content:
COP 311 Transfer processes 311
Academic organisation: Chemical Engineering
Prerequisite: WTW 238, (WTW 263)
Contact time: 3 tpw 4 lpw
Period of presentation: Semester 1
Language of tuition: English
Credits: 16
Module content:

CPB 410 Process control 410
Academic organisation: Chemical Engineering
Prerequisite: CPN 321 GS
Contact time: 3 tpw 4 lpw
Period of presentation: Semester 1
Language of tuition: English
Credits: 16
Module content:

CPJ 421 Design project 421
Academic organisation: Chemical Engineering
Prerequisite: (CPB 410), (CRO 410); BSS 310, CIO 320, CPS 420#, CPR 420#
Contact time: 1 tpw
Period of presentation: Semester 2
Language of tuition: English
Credits: 24
Module content:
Application of chemical engineering principles for the complete design of a chemical plant.

CPN 321 Process dynamics 321
Academic organisation: Chemical Engineering
Prerequisite: CIO 310/320#, CKN 321#
Contact time: 3 tpw 4 lpw
Period of presentation: Semester 2
Language of tuition: English
Credits: 16
Module content:
CPO 732 Product design 732
Academic organisation: Chemical Engineering
Contact time: 24 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English
Credits: 32
Module content:
The methodology to develop chemical products involves assessing needs, generating ideas, sorting and screening ideas, development of good ideas, and assessment of manufacturing methods. Engineering principles must be used to estimate whether the performance of the product will meet requirements, and involves the application of e.g. thermodynamics of mixing, phase equilibrium, solutions, surface chemistry, diffusion and transport properties. Students will choose a need for suitable chemical product, and implement the product design process and techniques to arrive at a unique product that meets the need. Students will present their projects both orally and as a written report.

CPP 732 Polymer processing 732
Academic organisation: Chemical Engineering
Contact time: 32 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English
Credits: 32
Module content:

CPR 420 Chemical engineering practice 420
Academic organisation: Chemical Engineering
Prerequisite: CLB 321
Contact time: 1 tpw 2 lpw
Period of presentation: Semester 2
Language of tuition: English
Credits: 8
Module content:
Design economics and process evaluation. Cost estimation and time-value of money.
Control applications, choice of instrumentation and development of a plantwide control strategy. Development of PandID’s. Safety: Site plan and layout, area classification, hazard and operability analysis (HAZOP). Occupational Safety and Health Act, Engineering Profession of South Africa Act. Requirements to maintain continued competence and to keep abreast of up-to date tools and techniques. ECSA code of conduct, Continuing Professional Development, ECSA outcomes, ECSA process and reasons for registration as PrEng. Displays understanding of the system of professional development. Accepts responsibility for own actions. Displays judgment in decision making during problem solving and design. Limits decision making to area of current competence. Reason about and make judgment on ethical aspects in case study context. Discerns boundaries of competence in problem solving and design. Case studies typical of engineering practice situations in which the graduate is likely to participate.

CPS 410 Process synthesis 410
Academic organisation: Chemical Engineering
Prerequisite: CLB 321, CIR 310 GS
Contact time: 1 tpw 2 lpw
Period of presentation: Semester 1
Language of tuition: English
Credits: 8

Module content:
Development of new processing plants; Evaluating process alternatives; Developing a process flowsheet using a process synthesis approach. Applying thermodynamic principles to obtain an optimal synthesis route. Applications using computer packages.

CPS 420 Process analysis 420
Academic organisation: Chemical Engineering
Prerequisite: CPS 410
Contact time: 1 tpw 2 lpw
Period of presentation: Semester 2
Language of tuition: English
Credits: 8

Module content:

CPW 732 Polymer materials science and research 732
Academic organisation: Chemical Engineering
Contact time: 32 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English
Credits: 32

Module content:

CPY 311 Practical training 311
Academic organisation: Chemical Engineering
Prerequisite: (CIR 211)
Contact time: 1 opw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng
Credits: 16

Module content:
*Attendance module only
At the end of the second year of study, students in Chemical Engineering undergo at least six weeks of prescribed practical training in the industry. The student must also attend all excursions organised during the year by the department. A satisfactory report on the practical training must be submitted to the Faculty Administration within one week of registration. In exceptional circumstances the prescribed minimum period can be reduced, as approved by the Chairman of the School of Engineering.

CPY 411 Practical training 411
Academic organisation: Chemical Engineering
Prerequisite: (CMO 320/310), CPY 311
Contact time: 1 opw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng
Credits: 16
Module content:
*Attendance module only
At the end of the third year of study, students in chemical engineering undergo at least six weeks of prescribed practical training in the industry. The student must also attend all excursions organised during the year by the department. A satisfactory report on the practical training must be submitted to the department within one week of registration. In exceptional circumstances the prescribed minimum period can be reduced, as approved by the chairman of the School of Engineering.

**CRH 732 Bio-reaction engineering 732**
**Academic organisation:** Chemical Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
In depth understanding of the important metabolic pathways in microorganisms, black box models for describing stoichiometry of bioreactions, metabolic flux analysis as the basis for metabolic (genetic) engineering, kinetics of microbial conversions and basic bioreactor design.

**CRO 410 Reactor design 410**
**Academic organisation:** Chemical Engineering  
**Prerequisite:** CKN 321 GS  
**Contact time:** 3 tpw 4 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Heterogeneous catalysis: diffusion in reaction for catalyst pores and different catalyst geometries. Inter and intraparticle heat and mass transfer processes. Reactor design: energy and continuity equation for different types of reactor: stirred tank, pipe, radial flow, slurry and fluidised. Modelling of non-ideal flow in reactors.

**CRO 700 Research orientation 700**
**Academic organisation:** Chemical Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  

**CSC 411 Research project 411**
**Academic organisation:** Chemical Engineering  
**Prerequisite:** CLB 321, CPB 410 # and CRO 410 #  
**Contact time:** 1 tpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
The execution of a complete literature study and research project on a chosen subject.

**CSC 421 Research project 421**
**Academic organisation:** Chemical Engineering
Prerequisite: CSC 411
Contact time: 1 tpw
Period of presentation: Semester 2
Language of tuition: English  Credits: 16

Module content:
Interpretation of the research results of CSC 411. The writing of a project report and scientific article. Oral presentation and poster.

CSK 732 Separation technology 732
Academic organisation: Chemical Engineering
Contact time: 32 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English  Credits: 32

Module content:
Characterisation and classification of particulate solids, bulk and single particle properties (flowability, rheology, density, etc.), preparation of particles and powders, separation of particles from liquid, gas and solid-solid separation, unit operations involving solids (fluidisation, ion exchange, pneumatic transport, hopper design, etc.) behaviour of multi-component and multiphase systems.

CSP 732 Process control system research and development 732
Academic organisation: Chemical Engineering
Contact time: 32 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English  Credits: 32

Module content:

CSS 420 Specialisation 420
Academic organisation: Chemical Engineering
Prerequisite: CPJ 421#
Contact time: 4 lpw
Period of presentation: Semester 2
Language of tuition: English  Credits: 16

Module content:
A module to be selected from the list of available specialisation topics, including Process Control, Chemical Product Design, Environmental Engineering, Nuclear Engineering, Polymer Processing, Reactor Design, Water Utilisation Engineering and Optimisation techniques.

CTD 223 Thermodynamics 223
Academic organisation: Chemical Engineering
Prerequisite: CIR 211, MPR 212/213, (WTW 258)
Contact time: 4 lpw 3 tpw
Period of presentation: Semester 2  
Language of tuition: English  
Credits: 16

Module content:  

CVD 800 Dissertation 800  
Academic organisation: Chemical Engineering

CVD 807 Dissertation 807  
Academic organisation: Chemical Engineering

CYM 732 Additive technology 732  
Academic organisation: Chemical Engineering  
Contact time: 32 contact hours per semester  
Period of presentation: Semester 1  
Language of tuition: English  
Credits: 180

Module content:  
Property modification through reactive processing and additive compounding. Colorants and optical modifiers (pigments, dyes, absorbers and opacifiers), fillers and reinforcements; Stabilisers (anti oxidants, light stabilisers, flame retardants); Surfactants (antistatic, antifog and antiblock); Functional additives (gas absorbers, biocides, foaming agents, barrier additives and cross-linkers); Viscosity modifiers. Optimisation of formulations using statistical methods: Taguchi experimental designs and triangular formulation designs.

EAD 410 Electrical drives 410  
Academic organisation: Electrical, Electronic and Computer Engineering  
Prerequisite: ELX 311 GS and EDF 320 GS  
Contact time: 1 ppw 1 tpw 3 lpw  
Period of presentation: Semester 1  
Language of tuition: Both Afr and Eng  
Credits: 16

Module content:  
Single and three-phase DC-AC invertors, PWM, 4-quadrant conversion, DC and AC variable speed drives and high frequency transformer design.

EAD 732 Advanced classical optics 732  
Academic organisation: Electrical, Electronic and Computer Engineering  
Contact time: 32 contact hours per semester  
Period of presentation: Semester 1  
Language of tuition: English  
Credits: 32

Module content:  
Propagation and diffraction, linear optical systems theory, coherence, fundamentals of imaging, including MTF and basic aberration theory, some applications including: diffraction gratings, holography, gradient index media and periodic media.

EAI 320 Intelligent systems 320  
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: WTW 258 GS  
Contact time: 1 ppw 1 tpw 1 wbppw 3 lwp  
Period of presentation: Semester 1  
Language of tuition: Both Afr and Eng  
Credits: 16

Module content:
Practical application of neural networks, fuzzy logic, genetic algorithms and expert systems. Introduction to pattern recognition, optimization and problem solving using intelligent systems techniques.

EAI 732 Intelligent systems 732
Academic organisation: Electrical, Electronic and Computer Engineering  
Contact time: 10 lwp  
Period of presentation: Semester 1 or Semester 2  
Language of tuition: English  
Credits: 32

Module content:
This module provides the theoretical background necessary to understand, research and develop real-world software and hardware systems that incorporate and exhibit intelligent behaviour. The module incorporates advanced theory from fields such as Artificial Intelligence, Computational Intelligence, Machine Learning, Pattern Recognition and Signal Processing. Core topics of the module include: Bayesian Theory, Neural Networks, Kernel Methods, Graphic Models, and Numerical Bayesian Methods.

EAI 733 Advanced topics in intelligent systems 733
Academic organisation: Electrical, Electronic and Computer Engineering  
Prerequisite: EAI 732  
Contact time: 10 lwp  
Period of presentation: Semester 1 or Semester 2  
Language of tuition: English  
Credits: 32

Module content:
The aim of the module is to augment the general background provided by the EAI 732 module with the specific theoretical background required for MEng. The module will, depending on the intended research field of the student, incorporate advanced theory from fields such as: Digital Image Processing, Computer and Robotic Vision, Probabilistic Robotics, Data Fusion, Hardware and Software Parallel Processing, Real-Time and Reactive Systems.

EAS 410 Computer engineering: Architecture and systems 410
Academic organisation: Electrical, Electronic and Computer Engineering  
Prerequisite: EMK 310 GS  
Contact time: 1 ppw 1 tpw 3 lwp  
Period of presentation: Semester 1  
Language of tuition: English  
Credits: 16

Module content:
This module aims to provide a strong foundation for allowing students to understand modern computer architectures and systems. Microarchitectures and instruction set architectures (ISAs) will be studied in detail, as well as computer memory types and their organisation. The study will also cover performance acceleration techniques such as caching and pipelining. Topics relating to parallel processing will be studied, including instruction level parallel processing (SIMD), multi-threading and multi-core processors as well as their synchronisation. Specialised architectures and techniques used in embedded processors (such as those found in smartphones) will be explored. The module also
provides an overview of advanced computer communication buses, memory and storage systems prevalent in enterprise class computing (data centres), including topics such as: network-attached storage NAS, virtualisation, clusters, grid computing and cloud computing. Practicals will demonstrate various elements of computer architectures using VHDL.

**EBB 320 Control systems 320**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** ELI 220 GS  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  
Modelling and simulation of physical systems. Block and signal flow diagrams. State variable formulation. Time and frequency domain analysis. Stability and sensitivity. Design methods, cascade (e.g. PID) and feedback controllers.

**EBB 732 Biosignals and systems 732**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** Bio-engineering: Bioelectricity and Electronics EBE 732  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
The objective of the module is to teach the engineering student how to apply engineering tools to the analysis of biological systems for the purpose of (i) developing understanding of the anatomy and physiology of specific biological systems from an engineering perspective, (ii) deriving appropriate mathematical descriptions of biological systems, and (iii) engineering applicable therapeutic interventions. We will expand on the single nerve fibre studies considered in bioelectricity and electronics: where the latter examined the biophysics of single excitable cells (and electrostimulation thereof), this module will develop it into an analysis of the characteristics of populations of neurons. We will systematically develop a systems-level perspective, working our way through the hierarchical organisation of neural encoding and computation. Furthermore, we will discuss how to measure characteristics and parameters of a particular system (the auditory system) and how to glean information about lower hierarchical levels from these measurements. This is a course in modelling and measurement, using tools from signal processing, control systems, dynamics, probability theory, systems engineering and psychoacoustics.

**EBE 732 Bioelectricity and electronics 732**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
This module focuses on electrophysiology, using a quantitative approach. Topics covered in the first part of the module are: electrical properties of the nerve cell membrane, action potentials and the Hodgkin-Huxley model, cable theory, the neuromuscular junction, and extracellular fields. The second part of the module builds on this background to discuss the theory and practice of electrical nerve stimulation. Applications of the theoretical work is discussed, including functional electrical stimulation (e.g. electrostimulation used for standing and walking in paraplegics), and
cochlear implants for the deaf.

**EBI 732 Bioelectromagnetism and modelling 732**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** Undergraduate Electromagnetism EMZ 320 or equivalent  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32  

**Module content:**  
The course provides an introduction to modelling of bioelectromagnetic systems using numerical methods. It focuses on the study of the interaction of electromagnetic fields with biological systems and application of this knowledge in the modelling of biological volume conduction problems. The finite element technique is used to analyse volume conduction problems. Students are introduced to an industry standard finite element software package, ANSYS, that is used to complete the practical component of the course.

**EBN 111 Electricity and electronics 111**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  

**Module content:**  
Electrical quantities, units, definitions, conventions. Electrical symbols, ideal and practical current and voltage sources, controlled sources. Ohm’s law in resistive circuits, Kirchoff's current and voltage laws, resistors in series and parallel circuits, voltage and current division, mesh current and node voltage methods. Circuit theorems: Linearity, superposition, Thevenin and Norton equivalent circuits, sources transformation, power calculation, maximum power transfer. Energy storage elements: current, voltage, power and energy in inductors and capacitors, inductors and capacitors in series and parallel. Ideal operational amplifiers and applications: inverting and noninverting amplifiers, summing amplifiers, current sources, integrators.

**EBN 122 Electricity and electronics 122**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  

**Module content:**  
Electrical quantities, units, definitions, conventions. Electrical symbols, ideal and practical current and voltage sources, controlled sources. Ohm’s law in resistive circuits, Kirchoff's current and voltage laws, resistors in series and parallel circuits, voltage and current division, mesh current and node voltage methods. Circuit theorems: linearity, superposition, Thevenin and Norton equivalent circuits, sources transformation, power calculation, maximum power transfer. Energy storage elements: current, voltage, power and energy in inductors and capacitors, inductors and capacitors in series and parallel. Ideal operational amplifiers and applications: inverting and noninverting amplifiers, summing amplifiers, current sources, integrators.

**EBO 780 Optimal control 780**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** Introductory control course such as EBB 320  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1
**Language of tuition:** English  
**Credits:** 32  

**Module content:**  
Optimal control of dynamic systems: continuous time systems, the Euler Lagrange equations, minimum time problems, the Pontryagin maximum principle; feasible control: computation of control input strategies for nonlinear systems such that the given control specifications are satisfied; feedback control of dynamic systems: dynamic programming for continuous time and discrete time nonlinear systems; applications in manufacturing systems; parametrisations of nonlinear/intelligent controller structures and applications of feasible control; linear systems: linear optimal control, linear optimal observers; application of feasible control in the computation of linear optimal output feedback controllers such that the design specifications are satisfied including: robustness against parameter variations, disturbance rejection, command following, frequency domain specifications.

**EBT 410 Automation 410**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** EBB 320 GS  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  

**Module content:**  

**ECW 710 Wireless telephony 710**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32  

**Module content:**  
Semester: Year course through CE@UP.  
The Centre for Radio and Digital Communications (CRDC), within the Department of Electrical, Electronic and Computer engineering, University of Pretoria in collaboration with Motorola has developed a unique Certificate Course in Wireless Telephony (CCWT). With the emergence of 2.5G and 3G technologies and the convergence between IT and Cellular technologies, training engineers for these developments in crucial. This programme offers the person with certain common telecommunication principles and training in fundamental mobile principles to a specific system generation. The practical/laboratory component attempts to firmly embed these “cutting edge” wireless communications learning outcomes.

**EDC 310 Digital communication 310**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** ELI 220 GS  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  

**Module content:**  
Basic Signals Theory, Transform theory (Fourier, Laplace and Z-transform) and Linear Systems. Overview of stochastic processes: Stationarity and ergodicity. Noise and

EDF 320 Power electronics 320
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: ELX 311 GS, ELI 220 GS
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng
Credits: 16

Module content:

EED 780 Power electronics 780
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: Undergraduate level Power electronics
Contact time: 32 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 32

Module content:
Power semiconductors - basic structure, I-V characteristic physics of device operation, switching characteristics, SOA; passive components; converter topologies - AC-DC rectifiers, DC-DC converters, DC-AC inverters, AC-AC converters and resonant converters; Dynamics and control - state space models, feedback control design; Ancillary issues - gate and base drives, snubber circuits and clamps, thermal modelling and heatsinking; Applications - electric utility applications, isolated switch-mode power supplies, optimising of the utility interface with power electronic systems.

EEO 732 Electro-optics 732
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: Telecommunications ETK 320 and Microwaves and antennas EMZ 320 or BEng (Electronic Engineering)
Contact time: 32 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 32

Module content:
The module covers the different parts of photonic systems, such as an optical telecommunication system. The contents include: laser sources (laser principles, semiconductor lasers), modulators (electro-optic, magneto-optic, acousto-optic), media (free space propagation, Gaussian beams, optical fibre) and detectors (photocative, photo-voltaic).

EER 891 Dissertation 891
Academic organisation: Electrical, Electronic and Computer Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng  
Credits: 180

EES 424 Specialisation 424
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: ERS 220
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 2
Language of tuition: English  
Credits: 16
Module content:
Semiconductor physics: materials, doping, carrier drift and diffusion. Device physics. Integrated circuit (IC) fabrication technology. IC layout design. Digital IC design: MOS inverters; static, transfer and dynamic logic gates; sequential gates; design topics: high speed, low power, clock and power distribution. Computer-aided design of integrated circuits. VHDL Hierarchy Revisited. Specialist topics are included for specific niche areas.

EES 732 Energy management 732
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 32 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English  
Credits: 32
Module content:
Energy management theory, energy policy and strategic planning, load factor, diversity factor, load profiles, disaggregated load profiles, load duration plots, scatter plots, co-incident maximum demand, after-diversity maximum demand, seasonal swing, energy auditing, electricity pricing theory, electricity tariffs, energy norms, energy process modelling, demand-side management.

EEV 732 Power distribution engineering 732
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 32 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English  
Credits: 32
Module content:
Utility source, medium voltage distribution, balanced and unbalanced fault conditions and selection of protective equipment: First cycle fault current calculations, contact parting symmetrical current calculations, power circuit breaker selection. Shunt capacitors: Selection, transients. Motors and motor starting, power quality issues: dips, harmonics, unbalance and flicker.

EEY 890 Dissertation: Micro-electronic engineering 890
Academic organisation: Electrical, Electronic and Computer Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng  
Credits: 180

EFR 716 Interferometry 716
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 16 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English  
Credits: 16
Module content:
Credits: 16 (must be combined with Introduction to the science of measurement to form a 32 credit module)
Theory: Michelson interferometer, Mach-Zehnder interferometer, Shack-Hartmann interferometer, Fabry-Perot interferometer, introduction to polarisation interferometry, introduction to interference microscopy, introduction to optical thin films.
Practical: alignment of optical flats, evaluation of optical surfaces, interpretation of interferograms obtained from a Fisba interferometer, interpretation of Newton fringes, application of a wedge interferometer to determine the thickness of a thin film.

**EGH 732 Renewable energy 732**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1 or semester 2  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
This course will cover various renewable energy technologies including Wind, Solar Photovoltaic systems, Distributed generation and Hybrid power system.

**EHN 410 e-Business and network security 410**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  
Commerce via the Internet, electronic payment systems, virtual organisations and electronic business. Introduction to data security, system security, network security, user considerations, firewalls, encryption, access control and social engineering.

**EIB 890 Dissertation: Bioengineering 890**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Period of presentation:** Year  
**Language of tuition:** Both Afr and Eng  
**Credits:** 180  

**EIC 990 Thesis: Biosystems 990**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Period of presentation:** Year  
**Language of tuition:** Both Afr and Eng  
**Credits:** 360

**EIN 732 Introduction to research 732**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 16 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
The aim of this module is to teach students to critically evaluate research literature, including conference papers and journal articles, in order to determine the current state of knowledge in a particular specialist area. It will also provide students with the principles of research to enable them to conduct research and prepare an original project in their particular specialist area.

**EIN 890 Dissertation: Electronic engineering 890**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Period of presentation:** Year  
**Language of tuition:** Both Afr and Eng  
**Credits:** 180

**EIN 990 Thesis: Electronic engineering 990**  
**Academic organisation:** Electrical, Electronic and Computer Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng  
Credits: 360

EIN 991 Thesis: Electronic engineering 991
Academic organisation: Electrical, Electronic and Computer Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng  
Credits: 360

EIR 211 Electrical engineering 211
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: EBN 111 or EBN 122 and WTW 161/164
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng  
Credits: 16

Module content:

EIR 221 Electrical engineering 221
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: EBN 111/122, WTW 161/164
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng  
Credits: 16

Module content:

EIR 890 Dissertation: Electrical engineering 890
Academic organisation: Electrical, Electronic and Computer Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng  
Credits: 180

EIR 990 Thesis: Electrical engineering 990
Academic organisation: Electrical, Electronic and Computer Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng  
Credits: 360

EIR 991 Thesis: Electrical engineering 991
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Period of presentation:** Year  
**Language of tuition:** Both Afr and Eng  
**Credits:** 360

**EIW 121 Information technology practice 121**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 36 opw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Module content:** *Attendance module only*  
This module is offered at the end of the first year of study. The duration is at least two weeks during which the students receive practical training in computers and computer networks. The module may for practical reasons be offered in a different time slot (e.g. at the beginning of the next year of study).

**EIW 221 Information technology practice 221**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** EIW 121  
**Contact time:** 36 opw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Module content:** *Attendance module only*  
This module is offered at the end of the second year of study. The duration is at least two weeks during which the students receive practical training in computers and computer networks. The module may for practical reasons be offered in a different time slot (e.g. at the beginning of the next year of study).

**EIW 320 Information technology practice 320**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** EIW 221  
**Contact time:** 36 opw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Module content:** *Attendance module only*  
This module is offered at the end of the third year of study. The duration is at least two weeks during which the students receive practical training in computers and computer networks. The module may for practical reasons be offered in a different time slot (e.g. at the beginning of the next year of study).

**EJJ 210 Professional and technical communication 210**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 2 lpw 2 opw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Module content:**  
Communicate effectively, both orally and in writing, with engineering audiences and the community at large. Written communication as evidenced by: uses appropriate structure, use of modern or electronic communication methods; style and language for purpose and audience; uses effective graphical support; applies methods of providing information for use by others involved in engineering activity; meets the requirements of the target audience. Effective oral communication as evidenced by appropriate structure, style and language; appropriate visual materials; delivers fluently; meets the requirements of the intended audience. Audiences range from engineering peers,
management and lay persons, using appropriate academic or professional discourse. Typed reports range from short (300-1 000 word plus tables diagrams) to long (10 000-15 000 words plus tables, diagrams, references and appendices), covering material at exit level. Methods of providing information include the conventional methods of the discipline, for example engineering drawings, as well as subject-specific methods.

EKK 320 Power system components 320
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: EIR 211 GS, EIR 221 GS
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng
Credits: 16
Module content:

EKK 410 Power system analysis 410
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: EKK 320 GS
Contact time: 1 ppw 1 tpw 4 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng
Credits: 16
Module content:

EKS 732 Wireless sensor networks 732
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: Computer networks ERN 780
Contact time: 32 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 32
Module content:
WSN consist of individual nodes interacting with their environment by sensing or controlling physical parameters; these nodes have to collaborate (using wireless communication) to fulfill their tasks. The course can be structured in two parts: architectures covering single node and network architectures, and communication protocols focusing on algorithms and protocols relevant to wireless sensor networks. The latter include the physical layer, MAC protocols, link-layer, naming and addressing, time synchronisation, localisation and positioning, topology control, routing protocols, data-centric and content-based networking, transport layer an QoS, and advanced application support (e.g. security).

ELB 780 Electronic Defence – Electronic Countermeasures 780
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 10 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 32

Module content:
Radar including aspects such as: radar frequency bands and their characteristics, radar types (e.g. tracking vs search radar), the radar range equation, radar cross-section (RCS), target characteristics such as scintillation and glint, pulse compression, coherent and non-coherent integration (e.g. Doppler processing), range and Doppler ambiguities, target tracking including simple tracking filters and angle-tracking techniques (e.g. monopulse), high range-resolution (HRR) techniques, and environmental effects such as atmospheric attenuation and multipath. Electronic attack (EA) – also referred to as jamming or electronic countermeasures (ECM) – including vulnerabilities of radar and communications systems, EA system architectures (e.g. digital radio-frequency memory (DRFM) systems), non-coherent and coherent jamming techniques. Electronic Protection (EP) – also referred to as electronic counter-countermeasures (ECCM) – including the relationship between good system design and EP, and basic EP techniques to counter the EA techniques listed above.

ELB 781 Electronic Defence – Electronic Support 781
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 32 contact hours per semester
Period of presentation: Semester 1 or semester 2
Language of tuition: English
Credits: 32

Module content:
The role of electronic support (ES) receivers from tactical and strategic perspectives. ES system architectures including analogue and digital receivers. The following topics will be considered: signal detection, parameter estimation including direction finding (DF)/angle of arrival (AoA) estimation and pulse repetition interval (PRI) tracking, emitter classification, and low probability of detection (LPD) and low probability of intercept (LPI) techniques to counter ES receivers.

ELI 220 Linear systems 220
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: EIR 211 GS/221 GS
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng
Credits: 16

Module content:

ELO 320 Electronic engineering design 320
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: EMK 310 GS
Contact time: 1 tpw 2 lpw 2 ppw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng
Credits: 16

Module content:
Electronic transducers. Circuit board layout: power circuit techniques, low noise techniques, high frequency techniques. Intellectual property law in South Africa. Design
and implement a group project: technical specifications and interface specifications, systems engineering, industry standards, architecture and engineering judgement, material procurement, documentation and configuration management, man/machine interfaces, packaging technology, ergonomics and aesthetics, complete design and construction of a system (including electromagnetic compatibility), design for manufacturing and maintainability, integration, production facilities and techniques, logistics.

**ELV 732 Solid-state lighting 732**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 2 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
Photometry (quantities, units and definitions), light and vision (photopic, scotopic and mesopic), solid-state light sources, LED and OLED sources (luminous efficacy, rated life, thermal dependence, etc.), drive and control electronics for SSL (linear and on-linear dimming, thermal and light feed-back control, luminaire fundamentals and design, lighting design (CAD), specific lighting applications (task and ambient, indoor and outdoor, safety and security, automotive), SSL measurements (photometric, colorimetric, electrical and thermal). Cost-effective energy efficiency: principles and life cycle cost calculations. International standards and testing.

**ELX 311 Electrical machines 311**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** EIR 211/221  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  

**EMA 780 Antenna theory 780**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** Microwaves and antennas EMZ 320 or equivalent  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
Types of antennas and radiation mechanisms, parameters of antennas, radiation integrals, near and far field radiation, duality theorem, wire antennas, antenna arrays, mutual coupling and mutual impedance, surface equivalence theorem, reaction theorem, moment methods in antenna analysis, travelling wave antennas, microstrip antennas, horn antennas, physical optics, reflector antennas, antenna synthesis.

**EMB 732 Multivariable control systems 732**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** Introductory control course such as EBB 320  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 2
Language of tuition: English  Credits: 32

Module content:

EME 310 Electromagnetic compatibility 310
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng  Credits: 16

Module content:
Introduction - electromagnetic spectrum, parameters of digital signals, circuit theory vs. microwave techniques; Transmission lines - lumped element model, transmission line equations, wave propagation, lossless lines, input impedance, short and open circuited and λ/4 lines, power flow, transients, S-parameters; Electrodynamics fields - plane waves, propagation in dielectrics and conductors, shields, Lenz’s law, Faraday’s law, Maxwell’s equations, transformers, storage fields vs. radiation fields, near and far fields, mechanisms of radiation; Static electric and magnetic fields – sources of fields, voltage, electrostatic induction, capacitance, electric and magnetic dipoles, permittivity, permeability, conductivity, magnetic materials, etc.; Non-ideal components – non-ideal resistor, - inductor, - capacitor, - wires, high-frequency measurements; Electromagnetic compatibility – spectrum of digital signals, interference, PCB layout, PCB shielding, grounding methods, power supply decoupling, ground loops, differential and common mode radiation, cable shielding.

EME 732 Analogue electronic design 732
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: Analogue electronic design EME 732 (E5), 3rd year Electronics or equivalent or permission from the lecturer
Contact time: 32 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English  Credits: 32

Module content:
The integrated circuit (IC) or “chip” is the motor of the present electronic revolution. The ever-increasing impact of electronics is driven mainly by large-scale ICs such as processor and memory chips. The electronic circuit techniques used in these chips can only be understood on a deep level by a study of classical analogue electronics aimed at integrated circuit design for fabrication in CMOS, bipolar and BiCMOS processes. In addition, analog circuit techniques perform an essential role in the interfaces between the “real world” and digital systems. Examples are: voltage references, amplifiers, filters, level-converters, buffers. Important topics in this respect are feedback and stability theory as specialized for electronic circuits. The course includes: IC fabrication technology, models for IC transistors, transistor current sources and amplifiers, output stages, operational amplifiers, frequency response and stability of feedback amplifiers, nonlinear and computational circuits.

EMK 310 Microprocessors 310
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: ERS 220 GS, ELI 220 GS, ENE 310/ENE 310#
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 1
Language of tuition: English  Credits: 16

Module content:
Hardware based introduction to system designing microprocessors. General microprocessor architecture assembly language and limited C embedded code development, with specific focus on a RISC (Microchip PIC 18) and MIPS (Microchip PIC 32) type processor, memory interfacing and address decoding, microprocessor input/output and interfacing, general programming concepts, general microprocessor system design principles, current trends and new processors exposure to development boards and integrated development environments.

EMK 732 Communication electronics 732
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 32 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English  Credits: 32

Module content:
Introduction to radio communication systems, small signal amplifiers, multistage amplifiers, differential amplifiers, network noise, intermodulation distortion, noise factor and sensitivity, frequency selective networks, impedance matching, high frequency amplifiers, broadbanding techniques, AGC, oscillators, phase-locked loops, PLL applications, frequency synthesizers, power amplifiers, modulators and demodulators, frequency mixers.

EMM 780 Microwave theory 780
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: Microwaves and antennas EMZ 320 or equivalent
Contact time: 32 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English  Credits: 32

Module content:
Review of EM theory and transmission lines, analysis of transmission lines and waveguides, microwave network analysis, impedance matching, power dividers, couplers and hybrids, microwave filters.

EMR 101 Introduction to laboratory measurements and computer simulations 101
Academic organisation: Electrical, Electronic and Computer Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng  Credits: 4

Module content:
This module is presented at the end of the first semester during the recess period and lasts for one week. This module serves as an introduction to measurement techniques and basic principles of a laboratory for electrical, electronic and computer engineering students. It also provides basic training in a computer simulation environment (Matlab, including Simulink) in the computer laboratories. The importance and complementary nature of simulations and accurate experimental measurements is emphasized in the module.

EMS 310 Modulation systems 310
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: ELI 220 GS
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng  Credits: 16
Module content:

EMZ 310 Electromagnetism 310
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: WTW 238 GS, WTW 263 GS, EIR 211/221 GS
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng
Credits: 16
Module content:
Transmission line equations, wave propagation, input impedance, power flow, Electrostatics, charge and current, laws of Coulomb and Gauss, scalar potential, properties of materials, boundary conditions, capacitance, Magnetostatics, laws of Biot-Savart and Ampère, magnetic properties of materials, boundary conditions, inductance; Faraday’s law, time harmonic fields, displacement current, boundary conditions; Plane wave propagation, polarization, power density; Wave reflection and transmission, normal and oblique incidence.

EMZ 320 Microwaves and antennas 320
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: EMZ 310 GS, ENE 310 GS
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng
Credits: 16
Module content:
Smith Chart Waveguides, stripline, microstripline; Network analysis, S-parameters, signal flow diagrams, matching networks; Power divider; Filter implementation, Richard’s transformation, Kuroda’a identities; Antenna fundamentals, port and radiation characteristics, Friis transmission equation, halfwave dipole, aperture antennas, linear arrays, microstrip patch antenna and arrays; Antenna applications, satellite, base stations, adaptive beams; Radar range equation.

ENE 310 Analogue electronics 310
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: ELI 220
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng
Credits: 16
Module content:
Amplifier concepts: gain, input impedance, output impedance, bandwidth, cascaded stages. Amplifier power dissipation and power efficiency. Operational amplifiers: non-ideal, limitations, low power, programmable. Diode operational circuits: Logarithmic amplifiers, peak detector, clamp, absolute value, voltage regulators. Feedback and

**ENE 410 Advanced electronics 410**
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** ENE 310 GS  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  
Bipolar and Field Effect Transistor (FET) amplifier design: bias and frequency response of small signal loaded single stage, multistage, differential stage, and feedback amplifiers. Amplifier figure of merit parameters, including total harmonic distortion. Large signal power amplifiers. Communication electronics: RF component modelling, two-port models for RF networks, matching networks, small signal narrowband RF amplifiers, RF oscillators.

**ENO 732 Energy optimisation 732**
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
In this module, a brief introduction about energy systems, energy system modelling and optimisation, and Matlab applications in energy optimisation problems are given. Practical industrial (as well as residential) energy management problems such as the load shifting for geysers, conveyor belts and pumping systems in terms of time-of-use tariff and/or maximum demand charge are covered.

**ENR 420 Energy systems 420**
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
This module consists of four parts: Energy system basics, solar energy systems, energy system modelling and optimisation, and advanced applications of energy systems. The first part (energy system basics) will include basic power and energy calculation, electricity tariffs, energy efficiency and the energy audit. The third part, energy system modelling and optimisation includes the general modelling processes and optimisation basics, linear programming and Matlab applications in energy optimisation. The last part on advanced applications of energy systems will be dynamically updated to cater for the national needs and international trends in energy efficiency and the topics covered can be energy management for any one or more of the commercial, industrial, residential or transport energy systems.

**EOD 732 Optical design 732**
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
Review of thin lenses, image formation and first-order properties of imaging systems, optical transfer functions, aberration theory, imaging systems: telescopes, microscopes,
etc., optical design methodology.

**EOP 732 Detection and estimation 732**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** Theory of bayesian inference ETB 732  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 32

**Module content:**

**EPE 321 Software engineering 321**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** COS 212  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16

**Module content:**
Software engineering deals with the application of engineering principles to develop and maintain high-quality software that is reliable and that works efficiently. Software engineering includes defining software requirements and performing software design, software construction, software testing, and software maintenance tasks. The module exposes students to various methodologies in the different stages of the software life cycle, the problems of group work, and software configuration management with versioning systems such as CVS. The student is exposed to object modelling techniques and languages such as UML, as well as advanced debugging and testing techniques.

**EPR 400 Project 400**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** EWE 320/ELO 320, Finalists only  
**Contact time:** 1 lpw  
**Period of presentation:** Year  
**Language of tuition:** Both Afr and Eng  
**Credits:** 64

**Module content:**
This module entails the individual completion of an engineering project from concept to delivery. The student must demonstrate independent mastery of an engineering project. The module focuses on the formulation of an engineering problem, the development of appropriate technical specifications, project planning and management and then completion of a technical project of a given nature, scope and complexity. The nature of projects is either mainly design (design, synthesis and testing) with a smaller component of investigation (experimental work and data analysis), or, alternatively, mainly investigation with a smaller component of design. As final step in the project, the student evaluates the final outcome of the design or investigation against the specifications and he/she also evaluates the impact of the project (social, legal, safety and environmental). Oral and written technical communication is evaluated as an important part of the module.
EPR 402 Project 402
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: ERD 320 Finalists only
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: Both Afr and Eng
Credits: 64

Module content:
This module entails the individual completion of an engineering project from concept to delivery. The student must demonstrate independent mastery of an engineering project. The module focuses on the formulation of an engineering problem, the development of appropriate technical specifications, project planning and management and then completion of a technical project of a given nature, scope and complexity. The nature of projects is either mainly design (design, synthesis and testing) with a smaller component of investigation (experimental work and data analysis), or, alternatively, mainly investigation with a smaller component of design. As final step in the project, the student evaluates the final outcome of the design or investigation against the specifications and he/she also evaluates the impact of the project (social, legal, safety and environmental). Oral and written technical communication is evaluated as an important part of the module.

EPR 890 Dissertation 890
Academic organisation: Electrical, Electronic and Computer Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng
Credits: 180

EPT 732 Research project: Theory 732
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 10 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 32

Module content:
This module will cover the essential theoretical background of the student's proposed MEng topic and include inter alia the following:
(i) Field definition and descriptions
(ii) In-depth study into background and theory relevant to the problem to be addressed
(iii) Problem definition and description
(iv) Mathematical simulations of the problem

EPT 733 Research project: Design and laboratory 733
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 10 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 32

Module content:
This module will include extensive laboratory experiments to test the principles and possible solutions of the proposed MEng research project and will include inter alia the following. These will include hardware and/or software experiments:
(i) Introduction to instrumentation and measuring techniques in general and specifically as applied in the field of research.
(ii) Structured laboratory work to introduce the specific problem investigated for the research undertaken.
(iii) Structured laboratory work to test the proposed solution for the problem
addressed.

(iv) Confirmation experiments.

EPW 200 Practical wiring 200
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 36 opw
Period of presentation: Year
Language of tuition: Both Afr and Eng  Credits: 4
Module content:
*Attendance module only
This module is presented during one of the recess periods during the second year. The duration is one week. During this period the student will become acquainted with relevant regulations and legislation and basic aspects of wiring practice. For practical reasons this module may be presented during another time slot, such as the beginning of the third year.

EPY 423 Practical training and report 423
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng  Credits: 16
Module content:
Four weeks practice-orientated experience at any institution of the student’s choice (preferably in electrical, electronic or computer engineering). The student must acquire experience in the working environment and more specifically work ethics, ecology, economy, punctuality, knowledge of human nature, etc. One week after the commencement of the second semester the student must submit a report on the aspects of his/her work experience as determined by the Head of the Department.

ERC 732 New generation networks 732
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: Computer Networks ERN 780 or BEng (Computer Engineering) UP or equivalent.
Contact time: 32 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English  Credits: 32
Module content:
The module in Next Generation Networks will cover evolution of communications networks towards multiservice networks and convergence. Topics be covered include the current PSTN architecture, convergence of enabling technologies, NGN architectures and APIs, softswitches, and modelling and simulation of multiservice networks. The main objective of the course is to prepare students for advanced research in next generation communications networks.

ERD 320 Computer engineering design 320
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: EMK 310 GS
Contact time: 1 tpw 2 lpw 2 ppw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng  Credits: 16
Module content:
Electronic transducers. Circuit board layout: power circuit techniques, low noise techniques, high frequency techniques. Intellectual property law in South Africa. Design and implement a group project: technical specifications and interface specifications,
systems engineering, Industry standards, architecture and engineering judgement, material procurement, documentation and configuration management, man/machine interfaces, packaging technology, ergonomics and aesthetics, complete design and construction of a system (including electromagnetic compatibility), design for manufacturing and maintainability, integration, production facilities and techniques, logistics.

**ERD 716 Introductory radiometry and photometry 716**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 16 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Introduction to laboratory equipment, solar cell, imaging radiometry, spectral radiometry, atmospheric transmittance, wavelength calibration of a monochromator, photometric measurements, measurement of colour.  
Credits: 16 (must be combined with Introduction to the Science of measurement to form a 32 credit module)

**ERI 890 Dissertation: Computer engineering 890**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Period of presentation:** Year  
**Language of tuition:** Both Afr and Eng  
**Credits:** 180

**ERI 990 Thesis: Computer engineering 990**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 360

**ERN 780 Computer networks 780**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
Review of computer networks infrastructure: The review will cover elementary concepts in computer networks; covering data communications, wide area networks, and local area networks.  
Networking protocols: This section will explore both the architectural principles and mechanisms required for the exchange of data among computers, workstations, servers, and other data processing devices. Much of the material in this part relates to the TCP/IP protocol suite. Recent developments and state-of-art issues will also be focused upon.  
Applications, service models and convergence of networks: This section will look at the application layer and explore various service models in the context of convergence. Students will be introduced to various Next Generation Networks technologies and issues. Modelling and simulation: This section will cover research issues in computer networks. Students will be introduced to modelling, simulation techniques and tools.

**ERP 420 Specialisation 420**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 1 ppw 1 tpw 3 lw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16
Module content:
Specific niche areas from computer engineering are addressed.

ERS 220 Digital systems 220
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng Credits: 16
Module content:
Introduction to digital circuit design, digital representations of numbers, device electronics in digital circuits, representation and simplification of logic functions, components of combinational circuits, analysis and design of combinational circuits, components of sequential circuits, analysis and design of sequential circuits, programmable components for combinatorial and sequential logic.

ERT 732 Advanced topics of energy research 732
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 32 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 32
Module content:
The module focuses on the research training on supply side, energy transmission, and demand side. Some related research papers and our finished projects will be taught. Energy optimisation techniques will be trained throughout the module. The teaching material also includes some of our newest research projects so that students are getting involved in most advanced research progresses. The expected learning outcomes are: (i) ability to identify if a problem is important to be investigated; (ii) ability to search references for research problems; (iii) ability to use energy management tools to model a research problem; (iv) ability to identify suitable optimization algorithms for an optimization problem arising from an energy management mathematical model; (v) ability to write research reports.

ESC 320 Stochastic communications systems 320
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: WTW 258, WTW 256, WTW 238 and EMS 310 GS
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng Credits: 16
Module content:

ESD 732 Electro-optical systems design 732
Academic organisation: Electrical, Electronic and Computer Engineering
Contact time: 32 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English Credits: 32
Module content:
Introduction to electro-optical system design, optical radiometry and photometry, atmospheric effects, advanced radiometry, signatures and camouflage, performance analysis, electro-optical system analysis, spectral band considerations.

ESP 300 DSP programming 300
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: EPW 200
Contact time: 36 opw
Period of presentation: Year
Language of tuition: Both Afr and Eng Credits: 4
Module content:
This module will deal only with the practical aspects of DSP applications: Universal applications of DSP (Space, medical, commercial, telecommunications, military, industrial and scientific); ADC and DAC; Discrete Fourier-Transform (DFT); Fast Fourier-Transform (FFT); z-Transform; Correlation and Convolution; Digital filter design; FIR and IIR filters; Adaptive digital filters; Computer architecture for DSP; Analysis of finite wordlength effects; Data, audio and video processing and compression. Simulation (MATLAB) and real-time implementation of selected signal processing algorithms on DSP hardware. Programming and mapping of DSP algorithms onto DSP hardware.

ESP 411 DSP programming and application 411
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: ESC 320 GS or EDC 310 GS
Contact time: 1 ppw 1 tpw 3 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng Credits: 16
Module content:
Fourier-Transform: revise the Discrete Fourier-Transform (DFT); Fast Fourier-Transform (FFT). Digital filters; cyclic convolution; overlap-and-add as well as overlap-and-save methods; design of FIR- and IIR-filters (incorporating the effect of finite word lengths). Implementation: computer architecture and DSP processors; Mapping of DSP algorithms onto DSP hardware. Projects: simulation (in C) and real-time implementation of selected signal processing algorithms on DSP hardware.

ESR 732 Digital radio techniques 732
Academic organisation: Electrical, Electronic and Computer Engineering
Prerequisite: Digital communications ETD 732
Contact time: 32 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 32
Module content:
Analog vs digital radio techniques, review of baseband and bandpass sampling concepts, overview of DSP-principles, Z-Transform and digital filter design, digital modulation techniques and performance analysis, radio link power analysis and design, generic radio configurations, low noise amplifier and radio front-end design, high-speed A/D and D/A components and design, automatic gain (power) control, direct versus superheterodine downconversion methods, IF-sampling techniques, digital radio
receiver design, analog vs digital (carrier and symbol) synchronisation methods, doppler tracking, analysis and design of diversity techniques, multiple-input/multiple output (multi antenna element) systems, space-time coding, modular embedded system design and rapid prototyping (RF, CMOS and FPGA implementation techniques and technologies), computer-aided design software, tools and techniques.

**ETA 732 Adaptive systems 732**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** Digital communications ETD 732  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
Adaptive systems ETA 732 covers the fundamentals of adaptive systems within the context of adaptive signal processing. The basic linear filtering problem with associated models and filter structures is introduced. Furthermore, the topics of stationary processes and models, spectrum analysis, eigen analysis, Wiener filters, linear prediction, Kalman filters, stochastic gradient methods and least squares methods are covered. Blind adaptive methods are presented within the context of the blind deconvolution problem. Lattice filter methods are covered as an extension to the basic topics of this course. Adaptive systems ETA 732 will supply the student with valuable tools for the solution of statistical detection and estimation problems in the diverse fields of communications, control, radar, sonar, seismology and biomedical engineering.

**ETD 732 Digital communications 732**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
Digital Communications ETD 732 is a first semester graduate course in Electronic Engineering, presented by the Signal Processing and Telecommunications Group, in collaboration with the Centre for Radio and Digital Communication (CRDC). The content of the course is as follows: Introduction to digital communications, digital communications applications and services. Review of: probability and stochastic processes, source coding, characterisation of communication signals and systems and optimum receivers for the AWGN channel. Advanced synchronisation systems: Carrier and symbol recovery. Shannon’s channel capacity theorem and introduction to coding. Signal design for band-limited channels. Digital modulation techniques. Communication through band-limited linear filter channels. Introduction to adaptive equalisation. Spread spectrum signals for digital communications. Simulation of digital communication systems. Digital realisation of digital communication subsystems. Digital communication laboratory.

**ETE 780 Electrical drives 780**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** Undergraduate level Power electronics and Electric machines.  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  

**ETH 780 Information security 780**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32

**Module content:**

**ETK 732 Coding theory 732**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** Digital communications ETD 732  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 32

**Module content:**
The course ETK 780 Coding theory addresses the analysis and design of block, convolutional and concatenated coding schemes for mobile fading channels. Information theory concepts, such as channel capacity and cutoff rates are addressed. Galois fields and mathematical operations are investigated. The construction of binary FIR and IIR convolutional codes, and non-binary dual-k convolutional codes are considered, followed by an in-depth discussion on the classic Viterbi algorithm. Binary block codes considered in this course include cyclic, Hamming and binary BCH block codes. Classic block code decoding algorithms, such as ML, syndrome and Meggit decoders are investigated. Non-binary Reed-Solomon block codes, as well as the Berlekamp-Massey decoding algorithm are presented. The Viterbi decoding of linear block codes, using BCJR trellises are investigated. The concept of coding for fading channels are considered, with the focus on aspects such as interleaving and employing channel state information in channel decoders. Classic concatenated coding schemes are considered. Iteratively decoded concatenated coding schemes, including iteratively decoded parallel, serial and hybrid concatenated coding and coded modulation are investigated. This includes an in-depth study of iteratively decoded concatenated coding scheme building blocks, such as puncturers, interleavers, recursive systematic convolutional codes and MAP decoders. Several promising fields of channel coding currently receiving much interest, such as multilevel coding, space-time coding and bit-interleaved coded modulation, are also considered.

**ETP 732 Topics in photonics 732**

**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 32

**Module content:**
The purpose of the Topics in Photonics course is to create the opportunity for experts to give lectures on specialised topics in the field of photonics, thus providing students with the opportunity to capitalise on the specialised knowledge of experts that are not permanently affiliated to the University.

**ETR 732 Mobile communication 732**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 32

**Module content:**  

**ETT 732 Telecommunication systems engineering 732**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 32

**Module content:**  
Telecommunication systems engineering ETT 732 is a first semester graduate course in Electronic Engineering, presented by the Signals and Telecommunications Group. This module provides an Introduction to telecommunication concepts, telecommunication systems, virtual private networks (VPN), advanced intelligent networks (AIN), local number portability (LNP), computer-to-telephony integration (CTI), signalling system 7 (SS7), CTI technologies and application, ISDN, frame relay, ATM, ATM and frame relay internetworking, data over power lines, xDSL, microwave and radio-based systems, local multipoint distribution services (LMDS), specialized mobile radio (SMR), cellular communication, GSM, personal communication services (PCS), wireless data communication (Mobile IP), satellite communication (Networking, LEO), Sonet and SDH, wave division multiplexing (WDM), the internet (TCP/IP, VoIP, networking, management).

**EWE 320 Electrical engineering design 320**  
**Academic organisation:** Electrical, Electronic and Computer Engineering  
**Prerequisite:** EIR 211/221 GS  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16

**Module content:**  
Introduction to system level design; the system design process; design for operational feasibility; power transformer design; power cable design; power capacitor design; protection system design; introduction to electrical design software; design project.

**GMI 210 Mineralogy 210**  
**Academic organisation:** Materials Science and Metallurgical Engineering  
**Contact time:** 2 tpw 4 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16
Module content:
Crystallography and internal order in minerals (space groups, unit cells, X-ray diffraction data). Bonding, mineral chemistry and solid solution (types of solid solution, calculation of mineral formulae and cation valency). Subsolidus reactions and defects in minerals (thermodynamic basis, defects, importance of subsolidus reactions). Classification and crystal structures of minerals. Mineralogical instrumentation and analysis. Major rock types and their classification. Mineralogical aspects of minerals processing.

IAM 801 Engineering asset management 801
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English Credits: 10

IBB 780 Asset Management 780
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours
Period of presentation: Semester 1 and Semester 2
Language of tuition: English Credits: 16

Module content:
"Asset Management" may be defined as a life cycle process for creating, establishing, maintaining, operating, rehabilitating and divesting an asset in an optimal or balanced manner to satisfy the constraints imposed by economy, ergonomics, technical integrity and business performance. Within this definition, physical assets include equipment, infrastructure, and people. The 'holistic' view implied here recognises the wider range of disciplines required for strategic decisions and tactical management of physical assets. Strategy and tactics depend on the asset, whereas people processes underpin the effective management of an asset.

The overall objective for the physical Asset Management module is to provide an integrated understanding of the complimentary disciplines applicable to the management of engineered assets. The module will emphasise the synergy between specialist and cross-disciplinary skills and their respective roles with respect to the management of physical assets. The overall outcome for the learner will be awareness of the collaboration required and application of cross-disciplinary skills in technical, engineering, finance logistics, human communication, and other functions to achieve effective management of physical assets.

IBD 780 Decision analysis and risk management 780
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English Credits: 16

IBI 801 Reliability engineering 801
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English Credits: 10

IEE 780 Technological entrepreneurship 780
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 1 and 2
Language of tuition: English Credits: 16
IGB 780 Research project 780
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 1 and 2
Language of tuition: English  Credits: 32
Module content:
The research project is the capstone of the MOT programme. It comprises an independent research study into an area of technology management, applying the principles learned during the programme. Although this is a research project of limited breadth and scope, it nonetheless has to comply with the requirements of scientific research on post-graduate level. The total volume of work that is to be invested in this module by an average student must be 320 hours. Normal requirements for assessment that include the use of an external examiner apply to this module.

IGB 801 Engineering services management 801
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English  Credits: 10

IGB 802 Advanced engineering services management 802
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English  Credits: 10

IGB 898 Mini-dissertation 898
Academic organisation: Engineering and Technology Management
Period of presentation: Year
Language of tuition: English  Credits: 60

IGB 990 Thesis: Engineering management 990
Academic organisation: Engineering and Technology Management
Period of presentation: Year
Language of tuition: Both Afr and Eng  Credits: 360

IHR 801 Project human resource management 801
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English  Credits: 10

IIB 801 Maintenance management 801
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English  Credits: 10

IIM 801 Marketing management 801
Academic organisation: Engineering and Technology Management
Contact time: 12 discussion classes
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng  Credits: 10
IIX 780 Engineering logistics 780
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English
Credits: 16

IIX 801 Engineering logistics 801
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English
Credits: 10

IKG 881 Technology commercialisation 881
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 30

IKK 801 Quality management 801
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English
Credits: 10

IKN 780 Engineering economics 780
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 1 and Semester 2
Language of tuition: English
Credits: 16

ILB 884 Information management 884
Academic organisation: Informatics
Contact time: 14 lpw 2 wbppw 22 opw 6 dpw
Period of presentation: Semester 1
Language of tuition: English
Credits: 10

ILC 803 Legal aspects of project management 803
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English
Credits: 10

ILS 801 Literature Study 801
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English
Credits: 10

ILS 802 Literature Study 802
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English
Credits: 30

ILE 802 Life cycle management of SHE 802
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English Credits: 16

IMC 780 Maintenance management 780
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 1 and Semester 2
Language of tuition: English Credits: 16

IMP 801 Project management practice 801
Academic organisation: Engineering and Technology Management
Contact time: 20 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 10
understanding of the system of professional development. Accepts responsibility for own actions. Displays judgment in decision making during problem solving and design. Limits decision making to area of current competence. Reason about and make judgment on ethical aspects in case study context. Discerns boundaries of competence in problem solving and design. Case studies typical of engineering practice situations in which the graduate is likely to participate.

**IPJ 801 Project procurement management 801**  
**Academic organisation:** Engineering and Technology Management  
**Contact time:** 20 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 10

**IPK 780 Project management 780**  
**Academic organisation:** Engineering and Technology Management  
**Contact time:** 20 contact hours per semester  
**Period of presentation:** Semester 1 and Semester 2  
**Language of tuition:** English  
**Credits:** 16

**IPK 803 Project management 803**  
**Academic organisation:** Engineering and Technology Management  
**Contact time:** 20 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 10

**IPK 990 Thesis: Project management 990**  
**Academic organisation:** Engineering and Technology Management  
**Period of presentation:** Year  
**Language of tuition:** Both Afr and Eng  
**Credits:** 360

**IPM 801 Introduction to project management 801**  
**Academic organisation:** Engineering and Technology Management  
**Contact time:** 20 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 10

**IPP 801 Production and operations management 801**  
**Academic organisation:** Engineering and Technology Management  
**Contact time:** 20 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 10

**IQM 801 Project quality management 801**  
**Academic organisation:** Engineering and Technology Management  
**Contact time:** 20 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 10

**IRI 801 Decision analysis and risk management 801**  
**Academic organisation:** Engineering and Technology Management  
**Contact time:** 20 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 10

**IRM 801 Project risk management 801**  
**Academic organisation:** Engineering and Technology Management
Contact time: 20 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 10

**ISC 780 Research project 780**  
**Academic organisation:** Engineering and Technology Management  
**Contact time:** 20 contact hours per semester  
**Period of presentation:** Semester 1 and 2  
**Language of tuition:** English  
**Credits:** 32

**Module content:**  
The research project is the capstone of the MOT programme. It comprises an independent research study into an area of technology management, applying the principles learned during the programme. Although this is a research project of limited breadth and scope, it nonetheless has to comply with the requirements of scientific research on post-graduate level. The total volume of work that is to be invested in this module by an average student must be 320 hours. Normal requirements for assessment that include the use of an external examiner apply to this module.

**ISC 898 Mini-dissertation 898**  
**Academic organisation:** Engineering and Technology Management  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 60

**ISE 780 Systems engineering 780**  
**Academic organisation:** Engineering and Technology Management  
**Contact time:** 20 contact hours per semester  
**Period of presentation:** Semester 1 and Semester 2  
**Language of tuition:** English  
**Credits:** 16

**ISE 801 Systems engineering and management 801**  
**Academic organisation:** Engineering and Technology Management  
**Contact time:** 20 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 10

**ISE 802 Project systems engineering 802**  
**Academic organisation:** Engineering and Technology Management  
**Contact time:** 20 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 10

**ISM 801 Strategic management 801**  
**Academic organisation:** Engineering and Technology Management  
**Contact time:** 20 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 10

**ISM 804 Strategic project management 804**  
**Academic organisation:** Engineering and Technology Management  
**Contact time:** 20 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 10

**ITB 801 Technology management 801**  
**Academic organisation:** Engineering and Technology Management
Contact time: 20 contact hours per semester  
Period of presentation: Semester 1  
Language of tuition: English  
Credits: 10

ITB 802 Technology management 802  
Academic organisation: Engineering and Technology Management  
Period of presentation: Semester 1 or Semester 2  
Language of tuition: Both Afr and Eng  
Credits: 30

ITB 890 Dissertation: Technology management 890  
Academic organisation: Engineering and Technology Management  
Period of presentation: Year  
Language of tuition: Both Afr and Eng  
Credits: 180

ITB 895 Dissertation 895  
Academic organisation: Engineering and Technology Management  
Period of presentation: Year  
Language of tuition: English  
Credits: 180

ITB 990 Thesis: Technology management 990  
Academic organisation: Engineering and Technology Management  
Period of presentation: Year  
Language of tuition: Both Afr and Eng  
Credits: 360

IVV 781 Operations management 781  
Academic organisation: Engineering and Technology Management  
Contact time: 20 contact hours per semester  
Period of presentation: Semester 1 and Semester 2  
Language of tuition: English  
Credits: 16

JCP 203 Community-based project 203  
Academic organisation: Informatics  
Contact time: 1 lpw  
Period of presentation: Year  
Language of tuition: Both Afr and Eng  
Credits: 8

Module content:  
This module is integrated into all undergraduate academic programmes offered by the Faculty. Main objectives: execution of a community project aimed at achieving a beneficial impact on a section of society; awareness of personal, social and cultural values and an understanding of social issues; and development of life skills. Assessment: project proposal, written progress reports, peer assessment, assessment by community, presentation, report presented in the form of a blog.

JPO 110 Professional orientation 110  
Academic organisation: EBIT Dean's Office  
Prerequisite: Pass JPO 110. Conditional entry into JPO 120: JPO 110 mark between 45% and 49%  
Pass JPO 110 and JPO 120: Final combined mark for JPO 110 and JPO 120 at least 50%  
Contact time: 4 ppw 6 tpw Foundation Course  
Period of presentation: Semester 1  
Language of tuition: English  
Credits: 8
Module content:
A project-based approach is followed towards the development of skills needed for success in engineering. Skills include communication, information technology, technology, academic and life skills. The modules are presented in English.

JPO 111 Additional Chemistry 1 111
Academic organisation: EBIT Dean's Office
Contact time: 1 lpw 3 tpw Foundation Course
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng Credits: 8
Module content:
Background knowledge, problem-solving skills, conceptual understanding and chemical reasoning skills required by CHM 171/172.

JPO 112 Additional electricity and electronics 112
Academic organisation: EBIT Dean's Office
Contact time: 1 lpw 3 tpw Foundation Course
Period of presentation: Semester 1
Language of tuition: English Credits: 8
Module content:
Background knowledge, problem-solving skills, conceptual understanding and reasoning skills required by EBN 111/122.

JPO 113 Additional graphical communication 113
Academic organisation: School of Engineering
Contact time: 1 lpw 3 tpw Foundation Course
Period of presentation: Semester 1
Language of tuition: English Credits: 8
Module content:
Background knowledge, conceptual understanding, drawing skills and reasoning skills required by MGC 110.

JPO 114 Additional programming 1 114
Academic organisation: EBIT Dean's Office
Contact time: 1 lpw 3 tpw Foundation Course
Period of presentation: Semester 1
Language of tuition: English Credits: 8
Module content:
Background knowledge, problem-solving skills, conceptual understanding and reasoning skills required by COS 132.

JPO 116 Additional mathematics 1 116
Academic organisation: EBIT Dean's Office
Contact time: 1 lpw 3 tpw Foundation Course
Period of presentation: Semester 1
Language of tuition: English Credits: 8
Module content:
Background knowledge, problem-solving skills, conceptual understanding and mathematical reasoning skills required by WTW 158.

JPO 120 Professional orientation 120
Academic organisation: EBIT Dean's Office
Prerequisite: Pass JPO 110. Conditional entry into JPO 120: JPO 110 mark between 45% and 49%
Pass JPO 110 and JPO 120: Final combined mark for JPO 110 and JPO 120 at least 50%

**Contact time:** 4 ppw 6 tpw Foundation Course

**Period of presentation:** Semester 2

**Language of tuition:** English

**Credits:** 8

**Module content:**
A project-based approach is followed towards the development of skills needed for success in engineering. Skills include communication, information technology, technology, academic and life skills.

**JPO 121 Additional Chemistry 2**

**Academic organisation:** School of Engineering

**Contact time:** 1 lpw 3 tpw Foundation Course

**Period of presentation:** Semester 2

**Language of tuition:** English

**Credits:** 8

**Module content:**
Background knowledge, problem-solving skills, conceptual understanding and chemical reasoning skills required by CHM 181

**JPO 122 Additional Physics**

**Academic organisation:** EBIT Dean's Office

**Contact time:** 1 lpw 3 tpw Foundation Course

**Period of presentation:** Semester 2

**Language of tuition:** English

**Credits:** 8

**Module content:**
Background knowledge, problem-solving skills, conceptual understanding and physical reasoning skills required by FSK 116/176.

**JPO 123 Additional materials science**

**Academic organisation:** EBIT Dean's Office

**Contact time:** 1 lpw 3 tpw Foundation Course

**Period of presentation:** Semester 2

**Language of tuition:** English

**Credits:** 8

**Module content:**
Background knowledge, problem-solving skills, conceptual understanding and reasoning skills required by NMC 113/123

**JPO 124 Additional programming**

**Academic organisation:** School of Engineering

**Contact time:** 1 lpw 3 tpw Foundation Course

**Period of presentation:** Semester 2

**Language of tuition:** English

**Credits:** 8

**Module content:**
Background knowledge, problem-solving skills, conceptual understanding and reasoning skills required by COS 110.

**JPO 125 Additional mechanics**

**Academic organisation:** EBIT Dean's Office

**Contact time:** 1 lpw 3 tpw Foundation Course

**Period of presentation:** Semester 2

**Language of tuition:** English

**Credits:** 8
**Module content:**
Background knowledge, problem-solving skills, conceptual understanding and reasoning skills required by SWK 122.

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**JPO 126 Additional mathematics 2 126**
**Academic organisation:** EBIT Dean's Office
**Contact time:** 1 lpw 3 tpw Foundation Course
**Period of presentation:** Semester 2
**Language of tuition:** English  
**Credits:** 8

**Module content:**
Background knowledge, problem-solving skills, conceptual understanding and mathematical reasoning skills required by WTW 164.

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**JPO 152 Additional Physics 152**
**Academic organisation:** School of Engineering
**Contact time:** 1 lpw 3 tpw
**Period of presentation:** Semester 1
**Language of tuition:** English  
**Credits:** 8

**Module content:**
Background knowledge, problem-solving skills, conceptual understanding and reasoning skills required by FSK116/176.

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**JPO 161 Additional Chemistry 1 161**
**Academic organisation:** School of Engineering
**Contact time:** 1 lpw 3 tpw
**Period of presentation:** Semester 2
**Language of tuition:** English  
**Credits:** 8

**Module content:**
Background knowledge, problem-solving skills, conceptual understanding and reasoning skills required by CHM 171/172.

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**KBS 803 Construction management 803**
**Academic organisation:** Construction Economics
**Contact time:** 10 lpw
**Period of presentation:** Semester 1
**Language of tuition:** English  
**Credits:** 10

**KBS 804 Construction management 804**
**Academic organisation:** Construction Economics
**Contact time:** 20 contact hours per semester
**Period of presentation:** Semester 1
**Language of tuition:** English  
**Credits:** 10

**KBS 805 Construction management 805**
**Academic organisation:** Construction Economics
**Contact time:** 20 contact hours per semester
**Period of presentation:** Semester 2
**Language of tuition:** English  
**Credits:** 10
MAE 780 Aeroelasticity / Aeroelastisiteit 780
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 16
Module content:
Lagrange’s equation, Rayleigh–Ritz method, Modal basis analysis, Structural Dynamics, Steady and unsteady aerodynamics, Panel methods, Static and dynamic aeroelasticity, Laplace transform, Convolution, Solution of the aeroelastic equation of motion.

MAH 780 Fluid-structure interaction 780
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 16
Module content:
Design of structures subjected to fluid flow, i.e., high-rise buildings, chimney stacks, tube in heat exchangers, overhead power-line bundles, bridge piers, risers, pipe lines under sea, stays, masts, chemical-reaction towers, offshore platforms and aircraft components.

MAN 420 Porous flow 420
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 1 ppw 3 lpw
Period of presentation: Semester 2
Language of tuition: English
Credits: 16
Module content:
Flow through porous media is relevant to applications such as internal combustion engines, thermal insulation engineering, electronics cooling, filtration, water movement in geothermal reservoirs, heat pipes, underground spreading of chemical waste, nuclear waste repository, geothermal engineering, grain storage, enhanced recovery of petroleum reservoirs and biological science. Introduction to the physical models used in the study of fluid flow and heat transfer in porous materials. Understanding of the transport mechanisms.

MAN 780 Porous flow 780
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 16
Module content:
Transport through porous media has raised considerable attention in recent decades due to its relevance in a wide range of applications such as vehicle engines, thermal insulation engineering, electronics cooling, filtration, water movement in geothermal reservoirs, heat pipes, underground spreading of chemical waste, nuclear waste repository, geothermal engineering, grain storage, enhanced recovery of petroleum reservoirs and biological science. This module gives an introduction to the physical models used in the study of fluid flow and heat transfer in porous materials, and will give
an understanding of the transport mechanism.

**MAY 780 Aircraft propulsion 780**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Review of thermodynamic cycles applicable to aircraft propulsion with emphasis on turbocharged piston cycles and gas turbine cycles. Optimisation of gas turbine cycles, 2D and 3D turbomachinery design and fluid mechanics and loss mechanisms in gas turbines.

**MBA 780 Solar energy 780**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
In this module the different solar-thermal systems will be introduced and analysed with the heat transfer and thermodynamics principles that apply. The main focus will include; sun-earth geometrical relations, solar radiation, energy requirements in buildings, energy storage, heating and cooling processes, bulk solar thermal power generation systems, life cycle costing and large scale plant specifics and quantification.

**MBB 410 Control systems 410**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** MVR 320 GS  
**Contact time:** 2 ppw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  

**MBB 780 Control Systems 780**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** Working knowledge of MATLAB/OCTAVE  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Introduction to state space methods, full state feedback design, disturbances and tracking systems, linear observers, compensator design by the separation principle, linear quadratic optimum control, Kalman filter, linear quadratic Gaussian compensator.

**MBT 780 Topology and shape optimisation 780**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16
Module content:
The topology optimisation method solves the basic engineering problem of distributing a limited amount of material in a design space. Material distribution methods, based on the use of mathematical programming and Numerical Schemes are used to determine the optimum architecture of a system and is used to identify possible shape and layouts of material. Applications of this optimisation method include optimisation of structural members, but can also be extended to flow and heat transfer optimisation.

MCM 780 Composite materials 780
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English Credits: 16
Module content:
Fundamental concepts of composite materials; manufacturing methods; design criteria of laminated composite materials; determining mechanical properties of composite materials: anisotropic elasticity and laminate theory, beams and columns of composite materials, plates and panels, transverse shear deformation effects, twisting and stretching shear coupling, composite shells; hygrothermal effects; strength and failure theories.

MCT 780 Non-destructive testing 780
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16
Module content:

MEE 780 Finite element methods 780
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: A working knowledge of MATLAB/OCTAVE or FORTRAN77
Contact time: 21 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English Credits: 16
Module content:

MEE 781 Advanced finite element methods 781
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: MEE 780
Contact time: 21 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English Credits: 16
Module content:

MEG 421 Mechatronics 421
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 1 ppw 3 lpw
Period of presentation: Semester 2
Language of tuition: English
Credits: 16
Module content:

MEG 780 Mechatronics 780
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 13 lpw
Period of presentation: Semester 2
Language of tuition: English
Credits: 16
Module content:

MEV 781 Vibration-based condition monitoring 781
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: Working knowledge of MATLAB/OCTAVE
Contact time: 21 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English
Credits: 16
Module content:
Vibration measurement: conventional and optical technique, digital signal processing in vibrations, vibration monitoring: diagnostics and prognostics, artificial intelligence in vibration monitoring, human vibration.

MGC 110 Graphical communication 110
Academic organisation: Mechanical and Aeronautical Engineering
**Contact time:** 3 lpw 3 tpw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  
Freehand sketching covering the following: perspective, isometric and orthographic drawings. Drawing conventions, graphical techniques and assembly drawings. Evaluation of drawings and error detection. True lengths of lines, projections and intersections. Practical applications of these techniques. Introduction to computer-aided drawings, including dimensioning, crosshatching and detailing. Introduction to basic manufacturing processes including primary (casting, forging and extrusion) and secondary (drilling, turning, milling, grinding, broaching and sawing) manufacturing procedures.

**MHM 420 Heat and mass transfer 420**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 1 ppw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  

**MHM 780 Advanced heat and mass transfer 780**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  

**MIA 320 Engineering activity and group work 320**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisites:** (BSS 310), (CJJ 310) or (EJJ 210) or (BJJ 210) or (MJJ 210) or (NJJ 210) or (PJJ 210)  
**Contact time:** 1 opw 2 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 8  
**Module content:**  
Two exit learning outcomes (ELO) of ECSA are addressed and each must be passed in the same semester. ELO7: Demonstrate critical awareness of the impact of engineering activity on the social, industrial and physical environment. The history of engineering globally and in South Africa. Most important engineering projects globally and in South Africa. The impact of technology on society. Occupational and public health and safety. Occupational Health and Safety Act. Impacts on the physical environment. The
personal, social, cultural values and requirements of those affected by engineering activity. The combination of social, workplace (industrial) and physical environmental factors are appropriate to the discipline of the qualification. ELO8: Demonstrate competence to work effectively on a small project as an individual, in teams and in multidisciplinary environments. Identifies and focuses on objectives. Works strategically. Executes tasks effectively. Delivers completed work on time. Effective team work: Makes individual contribution to team activity; performs critical functions; enhances work of fellow team members; benefits from support of team members; communicates effectively with team members; delivers completed work on time. Multidisciplinary work by the following: Acquires a working knowledge of co-workers’ discipline; uses a systems engineering approach; communicates across disciplinary boundaries. Report and presentation on team project. Tasks require co-operation across at least one disciplinary boundary. Students acquire a working knowledge of co-workers discipline. Students communicate between disciplinary boundaries.

**MIC 780 Condition-based maintenance 780**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:** 
Theory and practical applications of condition based maintenance techniques. Pitfalls of the various condition based maintenance techniques. Acoustic emission, wear debris monitoring, oil analysis, thermography and non-destructive testing.

**MII 420 Maintenance engineering 420**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 1 ppw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:** 

**MII 781 Reliability-based maintenance 781**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** MIR 781 Reliability engineering 781  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:** 
Component reliability: Weibull analysis, Limitations of Weibull analysis – when not to use it. System reliability and availability: reliability/availability modelling, the availability block diagram (ABD), Cut sets, capacity constraints, m-out-of-n systems and storage capacity, Fault trees, Failure modes, Effects and criticality analysis (FMECA). Failure
and repair rate data: Reliability engineering’s red herring: “We don’t have the data”, Some data banks that are in fact useful. Data synthesis: the method of paired comparisons, Paper on The use of NERC-GADS data in determining standards for system design, Case study in and exercise in data synthesis.

**MIN 990 Thesis: Metallurgical engineering 990**
*Academic organisation:* Materials Science and Metallurgical Engineering  
*Period of presentation:* Year  
*Language of tuition:* Both Afr and Eng  
*Credits:* 360

**MIP 780 Maintenance practice 780**
*Academic organisation:* Mechanical and Aeronautical Engineering  
*Contact time:* 21 contact hours per semester  
*Period of presentation:* Semester 1  
*Language of tuition:* English  
*Credits:* 16

*Module content:*  

**MIP 781 Maintenance practice 781**
*Academic organisation:* Mechanical and Aeronautical Engineering  
*Prerequisite:* MIP 780 Maintenance practice 780 (recommended)  
*Contact time:* 21 contact hours per semester  
*Period of presentation:* Semester 2  
*Language of tuition:* English  
*Credits:* 16

*Module content:*  

**MIP 782 Maintenance logistics 782**
*Academic organisation:* Mechanical and Aeronautical Engineering  
*Contact time:* 2 lpw  
*Period of presentation:* Semester 1  
*Language of tuition:* English  
*Credits:* 16

*Module content:*  
MIP 783 Maintenance operations 783
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 2 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  

MIR 781 Reliability engineering 781
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:** Introduction to probabilistic distributions, computation of system reliability, building reliability models and optimisation of system reliability; Fault Tree Analysis; Failure Modes, Effects and Criticality Analysis (FMECA), Monte Carlo Simulation; probability-based design.

MIR 890 Dissertation: Mechanical engineering 890
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Period of presentation:** Year  
**Language of tuition:** Both Afr and Eng  
**Credits:** 180

MIR 891 Dissertation 891
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Period of presentation:** Year  
**Language of tuition:** Both Afr and Eng  
**Credits:** 180

MIR 990 Thesis: Mechanical engineering 990
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Period of presentation:** Year  
**Language of tuition:** Both Afr and Eng  
**Credits:** 360

MIR 998 Thesis: Mechanics 998
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Period of presentation:** Year  
**Language of tuition:** Both Afr and Eng  
**Credits:** 360

MIT 780 Tribology 780
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 10 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16
Module content:

MJJ 210 Professional and technical communication 210
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 2 lpw 2 opw
Period of presentation: Semester 1
Language of tuition: English
Credits: 8
Module content:
Communicate effectively, both orally and in writing, with engineering audiences and the community at large. Written communication as evidenced by: uses appropriate structure, use of modern or electronic communication methods; style and language for purpose and audience; uses effective graphical support; applies methods of providing information for use by others involved in engineering activity; meets the requirements of the target audience. Effective oral communication as evidenced by appropriate structure, style and language; appropriate visual materials; delivers fluently; meets the requirements of the intended audience. Audiences range from engineering peers, management and lay persons, using appropriate academic or professional discourse. Typed reports range from short (300-1,000 word plus tables diagrams) to long (10,000-15,000 words plus tables, diagrams, references and appendices), covering material at exit level. Methods of providing information include the conventional methods of the discipline, for example engineering drawings, as well as subject-specific methods. Plagiarism policies and their implications.

MKI 420 Nuclear engineering 420
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 1 dpw 1 ppw 3 lpw
Period of presentation: Semester 2
Language of tuition: English
Credits: 16
Module content:

MKM 321 Solid mechanics 321
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: MOW 227
Contact time: 1 ppw 3 lpw
Period of presentation: Semester 2
Language of tuition: English
Credits: 16
Module content:
Introduction to continuum mechanics. Kinematics of deformation and the strain tensor.

**MKM 411 Computational fluid dynamics 411**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** (MTV 310), (MKN 321)  
**Contact time:** 1 ppw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**
Introduction to continuum mechanics, continuity equation, momentum equation, Navier-Stokes equation, energy equation, boundary conditions in thermal fluid systems, finite difference method, introduction to finite volume method (FVM), FVM for diffusion problems, FVM for convection-diffusion problems, introduction to pressure-velocity coupling in FVM. SIMPLE algorithm, selecting and assessing the applicability and limitations of the method, properly applying the method with commercial software, critically testing and assessing the end-results.

**MLD 780 Aerodynamics 780**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**
Review of the fundamentals of thermodynamics. Introduction to compressible flows. Advanced topics in compressible flows: transonic flow and supersonic flow. Oblique shock waves, expansion waves, shock-expansion theory, wave interactions and wave drag. Linearized compressible-flow theory. Effects of heat and friction on gas flow. Design aspects of high speed aeroplanes and viscous effects. Fundamentals of hypersonic flow and high temperature gas dynamics. On completion of this module the student will be able to understand the fundamental phenomena associated with compressible flow and competently apply analytical theory to compressible flow problems.

**MLD 781 Missile aerodynamics and design 781**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** (recommended) aircraft design, aerodynamics, flight mechanics  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**
The aerodynamic discipline of missiles or slender bodies and general configuration design concepts, submarine, airship and munition development. Slender body theory, aerodynamics of bodies, aerodynamics of low aspect ratio wings, vortices, wing body interference, downwash, the wake and wing tail interference, aerodynamic controls, drag, stability derivatives, design considerations, performance, manoeuvring flight, store carriage and separation. Prerequisites for the course are aircraft design, subsonic and supersonic aerodynamics (including the concepts of potential flow, vortex theory, thin aerofoil theory, finite wing theory, compressible gas dynamics and shock wave theory) and flight dynamics.

**MLD 782 Experimental methods 782**
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: (recommended) any module where experiments are frequent (such as Physics 1)
Contact time: 21 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English  
Credits: 16

Module content:
Terminology, Data analysis, Uncertainty, Displacement, Strain, Pressure, Flow measurements Temperature measurements. Emphasis will be placed on the experimental process from calibration through to analyses. Different experimental techniques will be covered to showcase the process.

MLD 783 Unmanned Aircraft Systems technology 783
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English  
Credits: 16

Module content:

MLD 784 Avionics 784
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English  
Credits: 16

Module content:
Introduction to the functions performed by the avionics system in modern aircraft; the way in which these functions are mapped to the avionics components, starting from a presentation of the major avionics function, and the associated equipment and technologies: Human / Machine Interface, Flight Sensing (attitude, altitude, airspeed), Navigation (INS, SATNAV, Radio Nav), Flight Control and Guidance (autopilot), Radio Communication, Engine Management, Mission Sensors (radar, optronics), Health and Usage Monitoring. The main engineering challenges in Avionics System design, system integration, flight testing, safety justification and certification.

MLG 780 Gas dynamics 780
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English  
Credits: 16

Module content:
Fundamentals of compressible flow, one dimensional flow, oblique shock and expansion waves, quasi-one-dimensional flow, differential conservation equations for invidic flows, unsteady wave motion, linearised flow, conical flow, 3D flow, transonic flow, hypersonic flow.

MLR 780 Air conditioning and refrigeration 780
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  

**MLT 780 Aeronautical structures 780**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  

**MLV 420 Aeronautics 420**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** MTV 310  
**Contact time:** 1 ppw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  

**MLV 780 Flight mechanics 780**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** Working knowledge of MATLAB/OCTAVE/Python or similar  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Introduction to flight mechanics, flight dynamics, flying qualities and flight simulation of fixed wing aircraft. Review of aerodynamic fundamentals with a particular focus on aerodynamic coefficients and derivatives. Brief review of aircraft propulsion. Aircraft performance, longitudinal and lateral trim, stability and control. Aircraft equations of
motion, axis transformations and state space modelling. Longitudinal and lateral transfer functions. Introduction to flying qualities, ratings, specifications, flight test and analysis techniques. Introduction to 6 degree of freedom flight simulation.

**MLW 780 Aircraft design 780**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Conceptual aircraft design, the design process, sizing, airfoil and geometry considerations, thrust and wing loading, configuration layout and loft, crew and passenger considerations, propulsion, landing gear, aerodynamics, structures, weights, stability and control, performance, cost analysis, trade off studies, design proposals.

**MOI 781 Structural control 781**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** MBB 780 Control systems 780  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Application of control techniques in order to actively control the dynamics of structures like beams and plates; pole placement technique, PID control, optimal control, feedback control and feed-forward control; using tools like SIMULINK that can be used to simulate active control.

**MOO 420 Optimum design 420**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 1 ppw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  

**MOO 780 Optimum design 780**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  

**MOW 217 Manufacturing and design 217**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** MGC 110  
**Contact time:** 3 lpw 4 tpw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16
Module content:
 Detailed exposure to manufacturing processes including heat treatment. Detailed exposure to machine elements. Conceptual framework for design process including life cycle, ergonomics, material selection, manufacturing and safety factor considerations.

MOW 227 Structural design 227
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: SWK 122
Contact time: 3 lpw 4 tpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng  Credits: 16
Module content:
 Analyse statically determinate structures to obtain section forces and moments and stress distributions. Thin-walled pressure vessels. Stress and strain transformations. Introduction of stress tensor. Derivation of stress transformation equations. Eigenvalue/ vector analysis for principle stresses and strains. Mohr’s circle. Failure criteria. Fatigue strength design. All analysis techniques above are applied to the open-ended design of components like beams and shafts.

MOW 312 Machine design 312
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: MOW 217, (MOW 227)
Contact time: 3 lpw 3 tpw
Period of presentation: Semester 1
Language of tuition: English  Credits: 16
Module content:
 Open-ended subsystem design using the following elements: Beams, shafts, bolts, bearings, rivets, welds, springs, couplings, clutches, brakes, gears and gear systems. Static and fatigue design fundamentals. Code design: Pressure vessels, structural steel design, hoisting systems and ropes, welding SANS code.

MOW 323 Simulation-based design 323
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: (MSD 210), MOW 227
Contact time: 3 lpw 5 tpw
Period of presentation: Semester 2
Language of tuition: English  Credits: 16
Module content:
 Computational dynamics analysis of mechanisms, linkages and cams. Structural computational analysis using finite element software. Systems engineering and functional analysis. Open-ended multidisciplinary design and design improvement of products and systems.

MOX 410 Design project 410
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: MOW 312 GS and MOW 323 GS
Contact time: 8 tpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng  Credits: 16
Module content:
 A comprehensive design in order to cover all the design aspects of functionality, analysis, ability to integrate, manufacturability and maintainability. Cost and reliability are included as inclusive factors.
MOX 780 Design 780  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
The objective of the module is to enable the engineer to plan and control design and development projects. System engineering. All aspects, from the concept phase to phasing out of the projects as well as supporting theory are covered. Technology forecasting: explanation and application. Project viability studies: explanation and application. Applicable practicals and assignments are used to equip the student to apply the theory. Student’s conducting a techno-economic study is used to integrate the different aspects of the subject.

MOX 781 Specialised design 781  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
This module allows the Head of the Department of Mechanical and Aeronautical Engineering to arrange a short course on a specialized nature in mechanical or aeronautical engineering, typically (but not limited to) a course presented by a visiting academic. The total volume of work that is to be invested in this module by an average student must be 160 hours. The body of knowledge studied must be of a specialized and advanced nature, at the level of the other postgraduate modules offered by the Department.

MOX 782 Specialised design 782  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
This module allows the Head of the Department of Mechanical and Aeronautical Engineering to arrange a short course on a specialized nature in mechanical or aeronautical engineering, typically (but not limited to) a course presented by a visiting academic. The total volume of work that is to be invested in this module by an average student must be 160 hours. The body of knowledge studied must be of a specialized and advanced nature, at the level of the other postgraduate modules offered by the Department.

MPR 213 Programming and information technology 213  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 4 lpw 2 ppw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  
Advanced spreadsheet applications: Named ranges, linear algebra, solution of systems of equations, regression, interpolation, optimisation and table manipulation. Basic structured programming: Looping, branching, subroutines, iteration, reading and writing data files. Development, coding and debugging of simple programs in a high level programming language. Programming principles are illustrated via mathematical
concepts such as limits, differentiation, integration and linear algebra. Structured
programming by making use of functions and available toolboxes. Basic graphical
output (plotting is also covered). Different information resources, searching and
management of information. Use of databases. Development of webpages. Hardware
interaction and control of equipment and systems.

MPY 315 Practical training 315
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 1 opw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng Credits: 16
Module content:
Prescribed practical training in industry during or at end of second year. Aim is exposure
to engineering equipment and processes, working environment of craftsmen and
personnel relations. Duration at least six weeks. Perform case study on personnel
management and submit together with a satisfactory report on the practical training, to
the Faculty Administration within one week of registration. Attend two (2) industry visits
in the first semester and two (2) industry visits in the second semester. Attend at least
six (6) guest lectures through the year.

MPY 415 Practical training 415
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 1 opw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng Credits: 16
Module content:
During or at the end of the third year of study, students in Mechanical Engineering
undergo prescribed practical training in the industry. The purpose is the execution of
small projects on engineering assistant level with exposure to the various relevant
functions in the organisation. The duration is at least six weeks. A case study on
occupational health and safety must be done in this period and submitted to the
department together with a satisfactory report on the practical training within one week
of registration. Students must also attend two (2) industry visits in the first semester and
two (2) industry visits in the second semester as well as attend at least six (6) guest
lectures through the year.

MSA 780 Smart materials 780
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 10 lpw
Period of presentation: Semester 1
Language of tuition: English Credits: 16

MRN 412 Research project 412
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: Finalists only
Contact time: 8 opw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng Credits: 16
Module content:
The module involves the management of the execution of a project that produces
knowledge and understanding of a phenomenon, conclusions and a recommended
course of action. The project is undertaken under the supervision of a staff member with
the student ultimately taking responsibility for the management of and execution of the
project. The student should be able to demonstrate competence in designing and conducting investigations and experiments and adherence to well defined time-lines and work breakdown structures. An acceptable process consists of but is not restricted to: (a) planning and conducting of investigations and experiments; (b) conducting of a literature search and critically evaluating material. The student should be able to demonstrate competence in engaging in independent learning through well-developed skills by: (a) reflecting on own learning and determining learning requirements and strategies; (b) sourcing and evaluating information; (c) determining learning requirements and strategies; (d) accessing, comprehending and applying knowledge acquired outside formal instruction; (e) critically challenging assumptions and embracing new thinking as well as communicating progress on a regular basis.

MRN 422 Research project 422

Academic organisation: Mechanical and Aeronautical Engineering

Prerequisite: Finalist only, MSC 412 or MRN 412, ARP 412

Contact time: 12 opw

Period of presentation: Semester 2

Language of tuition: Both Afr and Eng

Credits: 24

Module content:
The module involves the management of the execution of a project that produces knowledge and understanding of a phenomenon, conclusions and a recommended course of action. The project is undertaken under the supervision of a staff member with the student ultimately taking responsibility for the management of and execution of the project. This module follows onto MSC 412/MRN 412 and deals with the same topic in the same year. The student should be able to demonstrate competence in designing and conducting investigations and experiments and adherence to well defined time-lines and work breakdown structures. An acceptable process consists of but is not restricted to: (a) understanding of the stated problem, (b) developing a work breakdown structure, (c) performing the necessary analyses; (d) selecting and using appropriate equipment or software; (e) construction and instrumentation of an experimental set-up; (f) taking measurements; (g) analysing, interpreting and deriving information from data; (h) drawing conclusions based on evidence; (i) communicating the purpose, process and outcomes in a technical report, presentation and poster.

MSD 210 Dynamics 210

Academic organisation: Mechanical and Aeronautical Engineering

Prerequisite: FSK 116 or FSK 176 and SWK 122 and WTW 256 #

Contact time: 2 tpw 3 lpw

Period of presentation: Semester 1

Language of tuition: Both Afr and Eng

Credits: 16

Module content:

MSE 780 Theory of elasticity 780

Academic organisation: Mechanical and Aeronautical Engineering

Contact time: 21 contact hours per semester

Period of presentation: Semester 1 or Semester 2

Language of tuition: English

Credits: 16
Module content:
Mechanics of elastic deformable bodies, based on the fundamental concepts of modern continuum mechanics: kinematics, balance laws, constitutive equations; classical small-deformation theory; formulation of boundary-value problems of linear elastostatics; plane problem of elastostatics; variational formulations, minimum principles.

MSF 780 Fracture mechanics 780
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English
Credits: 16
Module content:
Historical development; Linear Elastic Fracture Mechanics (LEFM): Stress concentrations and singularities, stress intensity factor, stability of crack propagation; Elasto-plastic fracture mechanics: crack tip plasticity, small scale yielding, measurement of Kic, J-integral; Fatigue crack growth: Paris Law; life prediction; combined mode fracture, strain energy density methods.

MSM 780 Numerical thermoflow 780
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English
Credits: 16
Module content:
Fluid Mechanics refresher (governing equations, boundary conditions, application of inviscid, laminar and turbulent flow). Methods of weighted residuals (finite element, finite volume and difference methods). Mesh generation and boundary conditions: Types of mesh structured and unstructured mesh generation and application (inviscid flow, heat conduction etc.). Heat conduction: Governing equations, discretisation, finite approximation, solution methods (Gauss-Seidel, Tri-diagonal matrix algorithm) etc. This module is suited to postgraduate students doing research in thermofluids and who wants to use available CFD codes or who wants to write their own codes to solve fluid mechanics, heat and mass transfer problems.

MSM 781 Numerical thermoflow 781
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: MSM 780 Numerical thermoflow 780
Contact time: 21 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English
Credits: 16
Module content:
state of the art in turbulence modelling etc. Viscous boundary meshes: Background and objectives, internal and external flow, turbulence modelling considerations.

**MSS 732 Research study 732**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 12 opw  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 32  
This module allows a student to do research on a certain topic in mechanical or aeronautical engineering, as specified by a lecturer in the Department of Mechanical and Aeronautical Engineering, on an individual basis, under the supervision of that lecturer. The study should be seen as a precursor to the master’s degree research that may follow the honours degree. The total volume of work that is to be invested in this module by an average student must be 320 hours. The body of knowledge studied must be of an advanced nature, at the level of the other postgraduate modules offered by the Department. Normal requirements for assessment that include the use of an external examiner apply to this module also.

**MSV 780 Fatigue 780**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Fatigue principles addressing both elasticity and plasticity; notch effects; variable amplitude loading conditions; multi-axial fatigue and weld fatigue.

**MSX 780 Fluid mechanics 780**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  

**MSX 781 Advanced fluid mechanics 781**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** MSX 780 Fluid mechanics 780  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
turbulent-boundary-layer equations, velocity profiles, turbulent flow in ducts, flat plate flow, turbulence modelling.

**MSY 310 Structural mechanics 310**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** MOW 227, WTW 256  
**Contact time:** 1 ppw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  

**Module content:**  

**MSY 781 Specialised structural mechanics 781**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  

**Module content:**  
This module allows the Head of the Department of Mechanical and Aeronautical Engineering to arrange a short course on a specialized nature in mechanical or aeronautical engineering, typically (but not limited to) a course presented by a visiting academic. The total volume of work that is to be invested in this module by an average student must be 160 hours. The body of knowledge studied must be of a specialized and advanced nature, at the level of the other postgraduate modules offered by the Department.

**MSY 782 Specialised structural mechanics 782**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  

**Module content:**  
This module allows the Head of the Department of Mechanical and Aeronautical Engineering to arrange a short course on a specialized nature in mechanical or aeronautical engineering, typically (but not limited to) a course presented by a visiting academic. The total volume of work that is to be invested in this module by an average student must be 160 hours. The body of knowledge studied must be of a specialized and advanced nature, at the level of the other postgraduate modules offered by the Department.

**MSY 783 Experimental structural dynamics 783**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** A working knowledge of MATLAB/OCTAVE  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  

**Module content:**  
Spatial, modal and response models of structures, frequency response functions and the relationships between spatial, modal and response models for single degree of
freedom systems and multi-degree of freedom systems, modal analysis, operational modal analysis, updating finite element models.

**MTG 990 Thesis: Metallurgy 990**
*Academic organisation:* Materials Science and Metallurgical Engineering  
*Period of presentation:* Year  
*Language of tuition:* Both Afr and Eng  
*Credits:* 360

**MTV 310 Thermofluids 310**
*Academic organisation:* Mechanical and Aeronautical Engineering  
*Contact time:* 1 ppw 3 lpw  
*Period of presentation:* Semester 1  
*Language of tuition:* English  
*Credits:* 16

**Module content:**

**MTV 410 Thermofluids 410**
*Academic organisation:* Mechanical and Aeronautical Engineering  
*Contact time:* 1 ppw 3 lpw  
*Period of presentation:* Semester 1  
*Language of tuition:* English  
*Credits:* 16

**Module content:**

**MTV 420 Thermal and fluid machines 420**
*Academic organisation:* Mechanical and Aeronautical Engineering  
*Prerequisite:* MTV 310, (MTX 311)  
*Contact time:* 1 ppw 3 lpw  
*Period of presentation:* Semester 1 or Semester 2  
*Language of tuition:* English  
*Credits:* 16

**Module content:**
(i) Thermodynamics: Introductory thermodynamics with reference to power cycles. Energy systems and views, transformation of energy. Nuclear power.  
(v) Internal combustion engines: Spark ignition and compression ignition. Applications.
(i) Classification: kinetic and positive displacement pumps and compressors. Incompressible and compressible flow. Pump, compressor and fan theory.
(ii) Equipment: functioning, properties, characteristics and use of well-known pumps and compressors.

MTV 780 Specialised thermoflow 780
Academic organisation: Mechanical and Aeronautical Engineering
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 16
Module content:
This module allows the Head of the Department of Mechanical and Aeronautical Engineering to arrange a short course on a specialized nature in mechanical or aeronautical engineering, typically (but not limited to) a course presented by a visiting academic. The total volume of work that is to be invested in this module by an average student must be 160 hours. The body of knowledge studied must be of a specialized and advanced nature, at the level of the other postgraduate modules offered by the Department.

MTV 781 Specialised thermoflow 781
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 16
Module content:
This module allows the Head of the Department of Mechanical and Aeronautical Engineering to arrange a short course on a specialized nature in mechanical or aeronautical engineering, typically (but not limited to) a course presented by a visiting academic. The total volume of work that is to be invested in this module by an average student must be 160 hours. The body of knowledge studied must be of a specialized and advanced nature, at the level of the other postgraduate modules offered by the Department.

MTX 221 Thermodynamics 221
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: FSK 116 or FSK 176
Contact time: 1 ppw 1 tpw 3 lw
Period of presentation: Semester 2
Language of tuition: Double Medium
Credits: 16
Module content:

MTX 311 Thermodynamics 311
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: MTX 221
Contact time: 1 ppw 3 lpw
Period of presentation: Semester 1
Language of tuition: English
Credits: 16

Module content:

MTX 781 Advanced thermodynamics and energy systems 781
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English
Credits: 16

Module content:
Fundamental concepts of thermodynamics, total flow exergy, restricted dead state and unconstrained equilibrium state, heat transfer, fluid flow and chemical irreversibilities, thermodynamic optimisation, irreversibility distribution ratio, lost exergy, application of entropy generation minimisation (EGM) technique to the fundamentals of power generation, solar power, wind power, and low temperature refrigeration.

MUA 782 Reactor coolant flow and heat transfer 782
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: MUA 783
Contact time: 21 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English
Credits: 16

Module content:
Design of reactor coolant system, heat sources in reactor systems, heat transmission principles, heat transmission in systems with internal sources, temperature distribution along path of reactor coolant flow, heat transfer characteristics of fluids, heat transfer to boiling liquids, heat transfer characteristics of gasses.

MUA 783 Reactor engineering science 783
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English
Credits: 16

Module content:
Atomic structure, nuclear energy and nuclear forces, nuclear fission, nuclear reactions and radiation, energy removal, nuclear reactor systems, radiation protection, radiation shielding, meteorology, reactor safety analysis.

MUA 784 Reactor physics 784
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: MUA 783 Reactor engineering science 783
Contact time: 21 contact hours per semester
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16

**Module content:**  
Probability concepts and nuclear cross sections, multiplication factor and neutron flux, slowing-down process in the infinite medium, diffusion theory the homogeneous one-velocity reactor, Fermi age theory: the homogeneous multi-velocity reactor, transport theory, reflected reactors, reactor kinetics, heterogeneous reactors, control-rod theory.

**MUA 785 Reactor materials engineering 785**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** MUA 783 Reactor engineering science 783#  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16

**Module content:**  
Overview of the functions of the various classes of nuclear materials, elastic deformation, yielding and use of texture in nuclear components, atomic processes in plastic deformation and radiation damage, strength of engineering materials.

**MUA 786 Reactor materials engineering 786**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** MUA 785 Reactor materials engineering 785  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16

**Module content:**  
Creep deformation, fracture processes and metallurgical fracture mechanics, fatigue fracture in nuclear materials, fabrication processes of nuclear materials.

**MUA 787 Reactor stress analysis 787**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Prerequisite:** MUA 783 Reactor engineering science 783  
**Contact time:** 21 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16

**Module content:**  
General considerations, simple tension, bending in straight beams, torsion, plane stress and strain, strain energy, experimental stress analysis, rotational symmetry, stresses in flat plates, thermal stresses, beams on elastic foundations, buckling, design considerations.

**MUU 420 Fossil fuel power stations 420**  
**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 1 ppw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16

**Module content:**  
This module contains a comprehensive study of all mechanical systems and processes of a fossil fuel power station. Analysis of steam cycles, combined cycle power generation, fuels and combustion, the draught group, steam generators and turbines, condenser, feedwater and circulating water systems, coal and ash handling, compressor plant, water treatment, the importance of HVAC, control and instrumentation, control philosophies and environmental considerations.
MUU 781 Fossil fuel power stations 781
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 13 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 16
Module content:
This module contains a comprehensive study of all mechanical systems and processes of a fossil fuel power station. The module will include the analysis of steam cycles, combined cycle power generation, fuels and combustion, combustion mechanisms, combustion equipment and firing methods, the draught group, steam generators, steam turbines, condenser, feed water and circulating water systems, coal handling, ash handling, compressor plant, water treatment, the importance of HVAC, control and instrumentation, control philosophies and environmental considerations.

MVE 420 Vehicle engineering 420
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 1 ppw 3 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 16
Module content:

MVI 780 Vehicle dynamics 780
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English Credits: 16
Module content:

MVR 320 Vibration and noise 320
Academic organisation: Mechanical and Aeronautical Engineering
Prerequisite: (MSD 210)
Contact time: 1 ppw 3 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 16
Module content:
Introduction to vibration: basic concepts, classification, modelling elements. Single
degree of freedom systems: undamped and damped free vibration, undamped and
damped harmonic motion, non-periodic excitation, numerical integration. Multidegree of
freedom systems: discretisation, eigenproblem, co-ordinate coupling. Vibration control:
balancing, isolation, absorbers. Vibration and sound measurement: signal analysis,
modal testing, vibration monitoring. Continuum systems: string, bar, rod. Sound and
noise: metrics, measurement, legislation.

MVS 311 Manufacturing systems 311
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 1 ppw 3 lpw 3 tpw
Period of presentation: Semester 1
Language of tuition: English Credits: 16
Module content:
Basic knowledge of conventional manufacturing processes like casting, forming,
machining and joining. Modern manufacturing of plastic products, powder metallurgy,
micro-electronic manufacturing and non-traditional machining. Quality control by work-
holding devices, measurement, inspection and testing and determination of process
capability. Manufacturing automation, rapid prototyping and free form fabrication.
Manufacturing systems design concepts like Jobshop, Flowshop, Leanshop with linked
cells, Projectshop and continuous processing.

MWN 420 Numerical methods 420
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 1 ppw 3 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 16
Module content:
Solution of systems of linear algebraic equations. Both iterative and direct methods are
treated. Solutions are applied to both small and large scale systems. Solutions of
problems for ordinary differential equations, boundary-value problems for ordinary
differential equations and partial-differential equations.

MWN 780 Numerical methods 780
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16
Module content:
Solving systems of linear algebraic equations using direct and iterative methods from
small to large scale systems. Numerical solutions of nonlinear systems of equations.
differentiation. Numerical Integration. Numerical solutions to initial-value problems for
ordinary differential equations. Numerical solutions to boundary-value problems for

MWX 781 Nano and micro heat transfer 781
Academic organisation: Mechanical and Aeronautical Engineering
Contact time: 21 contact hours per semester
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16
Module content:
The applications of transport processes pose new challenges in emerging areas like
electronic cooling, Micro-Electro-Mechanical Systems (MEMS) and micro biological sciences. This involves devices where heat, species and fluid flows are involved within very small dimensions. Topics covered: Statistical thermodynamics, quantum mechanics, thermal properties of molecules, kinetic theory, micro/nanofluidics; thermal transport in solid micro/nanostructures, electron and phonon scattering, size effects, quantum conductance, electronic band theory, tunnelling, nonequilibrium heat conduction, analysis of solid state devices such as thermoelectric refrigeration and optoelectronics; nanoscale thermal radiation and radiative properties of nanomaterials, radiation temperature and entropy, surface electromagnetic waves, near-field radiation for energy conversion devices.

**MYI 990 Thesis: Mining engineering 990**
*Academic organisation:* Mining Engineering
*Period of presentation:* Year
*Language of tuition:* Both Afr and Eng
*Credits:* 360

**MYL 990 Thesis: Mining 990**
*Academic organisation:* Mining Engineering
*Period of presentation:* Year
*Language of tuition:* Both Afr and Eng
*Credits:* 360

**NEC 310 Electrochemistry 310**
*Academic organisation:* Materials Science and Metallurgical Engineering
*Contact time:* 3 lpw 3 ppw
*Period of presentation:* Semester 1
*Language of tuition:* English
*Credits:* 16

**Module content:**
Kinetics and thermodynamics of electrochemical reactions of metallurgical importance. Use of equilibrium diagrams to identify possible reactions products. Use of polarisation diagrams to describe reaction kinetics. Application of these principles to metallurgical examples, including corrosion, leaching and electrometallurgy. Influence of substrate composition, electrolyte composition, impurities, reaction products and agitation on kinetics.

**NEL 700 Electrometallurgy 700**
*Academic organisation:* Materials Science and Metallurgical Engineering
*Contact time:* 48 contact hours per semester
*Period of presentation:* Year
*Language of tuition:* English
*Credits:* 30

**Module content:**
At the end of the module, students should be able to conceptualise and design new electrometallurgical processes and improve the operation of existing processes through an understanding of the basic principles of the thermodynamics and kinetics of electrochemistry, measurement techniques used in electrochemistry, and considering the principles of electrochemical reactor design, different electrode and cell configurations, role of additives to electrolytes, role of impurities in the electrowinning process, the steps involved in electrocrystallization processes and present practices used for the electrowinning of metals such as copper, nickel, cobalt, zinc, manganese and gold.

**NEX 320 Excursions 320**
*Academic organisation:* Materials Science and Metallurgical Engineering
*Prerequisite:* (NMP 310)
*Contact time:* 1 lpw 6 ppw
Period of presentation: Semester 2  
Language of tuition: English  
Credits: 8

Module content:  
Attendance of and participation in excursions to metallurgical operations, including a five-day excursion tour during the last full week of the mid-year recess, and six half-day visits during the semester. Assessment is based on written reports and oral presentations. The plant visits include hydrometallurgical, pyrometallurgical, minerals processing and materials processing plants.

NFE 700 Fabrication engineering 700  
Academic organisation: Materials Science and Metallurgical Engineering  
Contact time: 48 contact hours per semester  
Period of presentation: Year  
Language of tuition: English  
Credits: 30

Module content:  
This module looks at quality assurance and control in welded fabrication and manufacture, and introduces various standards and codes of manufacture used in the welding industry. Measurement, control and recording in welding, the principle of fitness for purpose, as well as health and safety issues are addressed. Control of residual stresses and distortion during welding, non-destructive testing, repair welding, and the economics of welding are considered. This module also examines plant facilities, welding jigs and fixtures. Special emphasis is placed on the design and implementation of welding procedure specifications, procedure qualification records and quality control plans. A number of case studies are examined.

NFM 700 Physical metallurgy 700  
Academic organisation: Materials Science and Metallurgical Engineering  
Contact time: 48 contact hours per semester  
Period of presentation: Year  
Language of tuition: English  
Credits: 30

Module content:  
The module deals with the basic understanding of phase transformations in alloys, and its relationship with microstructure and mechanical properties of alloys. Included are transformation processes such as solidification; nucleation, growth and coarsening of precipitates; the use of carbides and intermetallic compounds in steels; static and dynamic re-crystallisation; grain growth and the use of grain boundary engineering; the martensite, bainite and pearlite transformations; thermomechanical processing and some elements of quantitative metallography. The course is practice orientated; the current best fundamental understanding of these transformation processes covered, and its role in engineering application demonstrated. The course is fully documented on CD-ROM from the latest literature and is largely intended for that research student who is embarking on a physical metallurgical research project.

NFM 701 Basic physical metallurgy 701  
Academic organisation: Materials Science and Metallurgical Engineering  
Contact time: 48 contact hours per semester  
Period of presentation: Year  
Language of tuition: English  
Credits: 32

Module content:  
This module serves as a bridge into full post graduate studies in physical and mechanical metallurgy for students who do not have a formal first degree in these subjects. The following topics are covered in this module: phases in alloys, diffusion, solidification, the precipitation of second phases in alloys and the recrystallisation and
grain growth of single phase alloys, aluminium and its alloys, copper and its alloys, nickel base alloys, the iron-carbon phase diagram, the heat treatment of steels, dislocations and the deformation of metals, engineering strength of metals and alloys, creep deformation, introduction to fracture mechanics and fatigue and failure analysis. This module will, therefore, enable the student to understand the fundamentals that govern alloy design, heat treatment, physical and mechanical properties and behaviour of materials during heat treatment and under stress and will enable the correct selection of alloys for a particular use, the prescription of heat treatments and further mechanical processing of these alloys to achieve the required metallurgical and mechanical properties.

**NHB 700 Heat treatment 700**

**Academic organisation:** Materials Science and Metallurgical Engineering  
**Contact time:** 48 contact hours per semester  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 30  
**Module content:**  
The emphasis is on the practice of the heat treatment of steels, covering the following topics: introduction and fundamental aspects of the Fe-C system; alloying elements; tempering of martensite; pearlite and bainite formation, hardenability; annealing, normalizing, hardening and tempering; stress relieving, use of CCT and TTT diagrams, HSLA steels, tool steels; stainless steels, heat treatment furnaces and their atmospheres, induction hardening, carburisation, nitriding, mechanical testing, non-destructive examination and heat treatment, hydrogen embrittlement, temper embrittlement, quantitative metallography for quality control, heat treatment for fracture toughness and heat treatment case studies. The course is partly available on CD-ROM with up-to-date references to the latest literature.

**NHM 322 Hydrometallurgy 322**

**Academic organisation:** Materials Science and Metallurgical Engineering  
**Prerequisite:** (NPT 220) and (NEC 310)  
**Contact time:** 3 lpw 3 ppw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Merits of hydrometallurgy relative to other extraction methods. Unit processes in hydrometallurgy. Chemical principles of hydrometallurgy. Chemistry of important metals and lixiviants. Application of chemical principles to: leaching; purification and upgrading of leach solutions (precipitation, solvent extraction, ion exchange, activated carbon); product recovery from solution (precipitation, reduction). Relevant analytical methods.

**NHM 412 Hydrometallurgy 412**

**Academic organisation:** Materials Science and Metallurgical Engineering  
**Prerequisite:** (NHM 322)  
**Contact time:** 2 tpw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Extraction routes and the extractive metallurgy of metals such as gold, copper, zinc, manganese, nickel, cobalt, uranium and the platinum group elements, from ores and secondary sources. Application of thermodynamics and reaction kinetics (including laboratory kinetic data) in understanding and optimisation of extraction routes, and sizing of reactors. Environmental impact of processing routes.
NHM 700 Hydrometallurgy 700
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 48 contact hours per semester
Period of presentation: Year
Language of tuition: English  Credits: 30
Module content:
The aim with this course is to enable the students to understand the design and operation of hydrometallurgical processes for the beneficiation of minerals and metals. The theoretical basis of the solution chemistry underlying hydrometallurgical processes, the purification and concentration options available, and the metal recovery processes such as precipitation, hydrogen reduction, and electrowinning are reviewed. This is then followed by the consideration of the engineering aspects and the technical application of hydrometallurgical processes for a number of ores relevant to South Africa.

NHM 701 Basic extractive metallurgy 701
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 48 contact hours per semester
Period of presentation: Year
Language of tuition: English  Credits: 32
Module content:
This module covers the fundamental principles of hydrometallurgy and minerals processing. In the minerals processing part of the module, students are given perspective on the scope of and functions in mineral processing, different unit operations and processing options for different deposits. Themes are comminution, classification, concentration, and solid-liquid separation. In the hydrometallurgy portion the merits and limitations of hydrometallurgy when compared with other metallurgical processes (e.g. pyrometallurgy) are considered; and different feed materials for hydrometallurgical processes; different unit processes in hydrometallurgy; fundamental thermodynamic and kinetic concepts as used in leaching; different leach reactors and their applications; solution purification and metal recovery processes; selecting a suitable flowsheet for a given feed material to produce a final metal product are discussed.

NIN 890 Dissertation 890
Academic organisation: Materials Science and Metallurgical Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng  Credits: 180

NIN 891 Dissertation 891
Academic organisation: Materials Science and Metallurgical Engineering
Period of presentation: Year
Language of tuition: Both Afr and Eng  Credits: 180

NJJ 210 Professional and technical communication 210
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 2 lpw
Period of presentation: Semester 1
Language of tuition: English  Credits: 8
Module content:
Communicate effectively, both orally and in writing, with engineering audiences and the community at large. Written communication as evidenced by: uses appropriate structure, use of modern or electronic communication methods; style and language for purpose and audience; uses effective graphical support; applies methods of providing information for use by others involved in engineering activity; meets the requirements of
the target audience. Effective oral communication as evidenced by appropriate structure, style and language; appropriate visual materials; delivers fluently; meets the requirements of the intended audience. Audiences range from engineering peers, management and lay persons, using appropriate academic or professional discourse. Typed reports range from short (300-1 000 word plus tables diagrams) to long (10 000-15 000 words plus tables, diagrams, references and appendices), covering material at exit level. Methods of providing information include the conventional methods of the discipline, for example engineering drawings, as well as subject-specific methods.

NKR 700 Corrosion 700
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 48 contact hours per semester
Period of presentation: Year
Language of tuition: English Credits: 30
Module content:
The aim with this course is to facilitate the development of the students in corrosion engineering by considering the electrochemical fundamentals of corrosion processes as well as their experimental and practical implications for corrosion diagnosis and control. The practical manifestations of the broad types of corrosion are reviewed and the skills of the students to utilise corrosion control methodologies such as chemical and electrochemical control, protective coatings and material selection to control corrosion are developed.

NLO 700 Research project 700
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 48 contact hours per semester
Period of presentation: Year
Language of tuition: English Credits: 30
Module content:
The refereed literature on a specific topic (normally related to subsequent research towards a master's degree) is studied and summarised in a written report. The important skills are finding appropriate papers, reading and comprehending these, and using the information in the paper to construct your own view on the research topic. There are no formal contact sessions. The written survey must be submitted at the end of October, with an oral presentation of 20-30 minutes in the week following submission of the survey.

NMC 113 Materials science 113
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 1 ppw 1 tpw 4 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng Credits: 16
Module content:
NMC 123 Materials science 123  
**Academic organisation:** Materials Science and Metallurgical Engineering  
**Contact time:** 1 ppw 1 tpw 4 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  

NMC 223 Materials science 223  
**Academic organisation:** Materials Science and Metallurgical Engineering  
**Prerequisite:** NMC 113 or NMC 123  
**Contact time:** 2 ppw 4 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Phase diagrams, phases and solid solutions. The heat treatment of steel (phase equilibria, the diffusion-controlled and martensitic transformations of austenite, hardening and tempering, hardenability, the application of IT and CCT diagrams, heat treatments). Steel types and classification. Cast irons (white, grey, malleable and spherical graphite irons). Stainless steels (ferritic, martensitic, austenitic and duplex types).

NMC 313 Materials science 313  
**Academic organisation:** Materials Science and Metallurgical Engineering  
**Prerequisite:** (NMC 223)  
**Contact time:** 3 lpw 3 ppw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Binary and ternary phase diagrams. Diffusion in alloys (steady-state and nonsteady-state, solid solutions, grain boundaries, homogenisation). Solidification (pure metals and alloys; ingots, castings and welds; segregation, porosity and eutectic solidification). Metallographic and analytical techniques (diffraction, electron microscopy). Precipitation and solid-solution strengthening (principles, and applications to aluminium, magnesium, copper and nickel-base alloys).

NMM 320 Mechanical metallurgy 320  
**Academic organisation:** Materials Science and Metallurgical Engineering  
**Prerequisite:** (NMC 223)  
**Contact time:** 3 lpw 4 ppw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Dislocations and deformation (defects in crystalline materials, movement and elastic

**NMM 700 Mechanical metallurgy 700**  
**Academic organisation:** Materials Science and Metallurgical Engineering  
**Contact time:** 48 contact hours per semester  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 30  
**Module content:**  
We cover the interaction between the internal structure of metals – on the atomic and microscopic scales – and their mechanical properties. Practically important topics such as elastic and plastic stress analysis, dislocations and deformation, room and high temperature deformation processes, mechanical property/microstructure relationships for low and medium Carbon steels and for micro-alloyed and HSLA steels, fatigue processes, stress corrosion cracking, creep deformation processes and fracture mechanics are covered in depth, and illustrated with case studies. The course is largely available on CD-ROM with references to the latest literature.

**NMP 310 Minerals processing 310**  
**Academic organisation:** Materials Science and Metallurgical Engineering  
**Contact time:** 3 lpw 4 ppw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  

**NMP 411 Minerals processing 411**  
**Academic organisation:** Materials Science and Metallurgical Engineering  
**Prerequisite:** (NMP 310)  
**Contact time:** 1 tpw 2 ppw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
The sizing, application and efficiency determination of the most commonly used unit operations covering crushing, screening, classification, milling, gravity concentration, dense medium separation, magnetic separation and thickening.

**NMP 700 Minerals processing 700**  
**Academic organisation:** Materials Science and Metallurgical Engineering  
**Contact time:** 48 contact hours per semester  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 30  
**Module content:**  
Principles and advanced theory of comminution, classification and density separation are covered.
NMP 701 Applied theory of sampling for minerals processing 701
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 48 contact hours per semester
Period of presentation: Year
Language of tuition: English Credits: 32
Module content:
This module covers both the theory and practice of sampling, primarily with respect to
the minerals processing industry. As sampling is statistical in nature, basic statistics
relevant to sampling theory will be considered. The module will then focus on the theory
of sampling with specific reference to managing large and small scale variability. The
effect of interpolation errors, periodic errors and increment weighting errors will be
considered under large scale variability. Under small scale variability the determination
and management of various errors that result in small scale variability will be covered,
as well as the compilation of sampling protocols that can minimise these errors. The
module will also examine the evaluation of dry and wet sampling equipment with
respect to the different bias generators, as well as the implementation of sampling
protocols in practice. Ore types covered during the course include coal, iron ore, gold
and platinum.

NNR 700 Nuclear reactor materials 700
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 10 lpw
Period of presentation: Year
Language of tuition: English Credits: 30
Module content:
In this module the mechanical behaviour of metals and alloys at room and high
temperature is addressed but with special emphasis on nuclear materials used in
commercial power reactors. In particular these materials’ behaviour under deformation,
creep, fracture, fatigue and also corrosion in irradiation conditions for in-core materials
as well as their behaviour under the unique environmental conditions for out-of-core
materials is covered.

NOP 421 Process design 421
Academic organisation: Materials Science and Metallurgical Engineering
Prerequisite: (NMP 411)
Contact time: 1 lpw 1 tpw
Period of presentation: Semester 2
Language of tuition: English Credits: 32
Module content:
Philosophy of design and the design process; phases of plant design and their
interrelationships. Principles of project planning and management. Unit and process
design, simulation, economic evaluation and optimising as applicable to the metallur-
gical industry. Execution of a process design project, submission of a report, oral
presentations and construction of a scale model.

NPA 700 Metallurgical analysis 700
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 24 contact hours per semester
Period of presentation: Semester 1
Language of tuition: English Credits: 16
Module content:
The aim is to solve metallurgical problems with the aid of hi-tech analytical techniques.
These different analytical techniques are given in modular form and the respective
metallurgical area of specialisation will dictate the combination of three techniques to suit the requirements of the research student. Specialisation areas like Physical Metallurgy, Welding Metallurgy, Hydro Metallurgy, Pyro Metallurgy and Minerals Processing are covered and any other combination can be requested by the study leaders after consultation with the course leader. The techniques included are TEM, SEM, Auger Spectroscopy (AES), X-ray Photo-electron Spectroscopy (XPS), Glow Discharge Optical emission Spectroscopy (GDOES), X-ray Diffraction (XRD), X-ray fluorescence (XRF), Gleeble hot working simulations and Dilatometry. Lectures cover the theory of these techniques in depth and the theory is illustrated with industrial case studies.

NPB 412 Process metallurgy and control 412
Academic organisation: Materials Science and Metallurgical Engineering
Prerequisite: (NPM 321)
Contact time: 1 tpw 2 lpw
Period of presentation: Semester 1
Language of tuition: English Credits: 8
Module content:
Elements of metallurgical process control (principles, selection of proportional-integral controller, identification of controlled and manipulated variables and disturbances). Transient and steady-state heat transfer in metallurgy (formation of freeze layers, heating and cooling of components). Principles of reaction kinetics in pyrometallurgy (types and identification of rate-determining steps, quantification of overall reaction rate).

NPM 321 Pyrometallurgy 321
Academic organisation: Materials Science and Metallurgical Engineering
Prerequisite: (NPT 220)
Contact time: 2 tpw 3 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 16
Module content:

NPM 700 Pyrometallurgy 700
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 48 contact hours per semester
Period of presentation: Year
Language of tuition: English Credits: 30
Module content:
We aim to provide you with practice in using fundamental principles to analyse pyrometallurgical processes – to be able to go from understanding to process improvement. To this end, the necessary fundamentals of reaction equilibria (including activity descriptions), reaction kinetics, and mass and energy balances are reviewed. Practical examples illustrate the use of these principles. In the final block, we analyse a number of practical processes in more detail. Throughout, the emphasis is on quantification, and at least half of the contact time is devoted to computer-based calculations.
NPM 701 Basic pyrometallurgy 701
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 48 contact hours per semester
Period of presentation: Year
Language of tuition: English Credits: 32
Module content:
In this module you will develop the skills required to analyse the equilibria of pyrometallurgical processes. Solving such a problem requires skills in thermodynamic analysis, and knowledge of the typical processes (and the conditions within these processes) which are used to extract and refine metals like iron (steel), copper, titanium, chromium, manganese, and aluminium. The aim is to enable you to analyse a current or proposed process with regards to feasibility, and to propose processing conditions (e.g. temperature, slag composition) which will achieve the required equilibrium state. This also applies to refractory systems, where the primary aim will be to evaluate whether a given refractory material is suitable for a given application, or the impact of certain impurities on the refractory material.

NPT 220 Process thermodynamics 220
Academic organisation: Materials Science and Metallurgical Engineering
Prerequisite: (CHM 171) or (CHM 172)
Contact time: 2 tpw 4 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 16
Module content:
The first, second and third laws of thermodynamics, enthalpy and heat capacity. The criteria for equilibrium, Gibbs free energy, chemical potential, partial molar Gibbs free energy, activity, activity coefficient and the equilibrium constant. Solution thermodynamics of ideal and non-ideal solutions, as well as solution models. Ellingham, Kellogg and Pourbaix diagrams. The thermodynamic principles are applied to metallurgical processes. Applications also include stoichiometry and mass balance problems, as well as the calculation of energy balances.

NPW 411 Metals processing 411
Academic organisation: Materials Science and Metallurgical Engineering
Prerequisite: (NMC 313), (NMM 320)
Contact time: 2 ppw 3 lpw
Period of presentation: Semester 1
Language of tuition: English Credits: 16
Module content:

NPY 316 Industrial training 316
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 1 opw
Period of presentation: Semester 1
Language of tuition: English Credits: 16
Module content:
*Attendance module only
During or at the end of the second year of study, students in Metallurgical Engineering undergo at least six weeks of prescribed training in industry. A satisfactory report on the practical training must be submitted to the Faculty Administration within one week of registration. In exceptional circumstances the prescribed minimum period can be reduced, as approved by the Dean.

**NPY 416 Industrial training 416**

**Academic organisation:** Materials Science and Metallurgical Engineering  
**Contact time:** 1 opw  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
*Attendance module only*

During or at the end of the third year of study, students in Metallurgical Engineering undergo at least six weeks of prescribed training in the industry. A satisfactory report on the practical training must be submitted to the department within one week of registration. In exceptional circumstances the prescribed minimum period can be reduced, as approved by the Chairman of the School of Engineering.

**NSC 412 Literature survey 412**

**Academic organisation:** Materials Science and Metallurgical Engineering  
**Prerequisite:** NEX 320  
**Contact time:** 1 tpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 8  
**Module content:**  
Literature search (using electronic databases of publications, formulating search strategies). Hypothesis formulation and preliminary experimental planning (identifying research question and stating hypothesis, proposing critical experiments, evaluating feasibility of possible experimental approaches). Literature survey (critical evaluation of published information, synthesising available information into a coherent argument, written and oral reporting). Final experimental planning (formulation of experiments with attention to calibration, uncertainty, reliability and safety).

**NSC 422 Project 422**

**Academic organisation:** Materials Science and Metallurgical Engineering  
**Prerequisite:** NSC 411 or NSC 412  
**Contact time:** 1 tpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
Execution of a research project: experimentation (with attention to safety, reliability, calibration and reproducibility); analysis of results to yield data (with statistical analysis of uncertainty); interpretation of data (to test the stated hypothesis); written reporting of results (with updated literature survey, description of experimental approach, data obtained, conclusions, and scientific and industrial implications); oral and poster presentations.

**NSF 700 Froth flotation 700**

**Academic organisation:** Materials Science and Metallurgical Engineering  
**Contact time:** 48 contact hours per semester  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 30
Module content:
Fundamentals of sulphide and coal flotation are covered, including the chemistry of sulphide mineral flotation; natural and induced hydrophobicity; physical and chemical interactions in coal flotation; review of sulphhydryl and oxydryl collectors and their absorption mechanisms; the role of activators/depressants and pH regulators as well as an investigation of frothers and froth stability, with reference to recent industrial developments. Aspects of flotation practice are addressed: Experimental methods for laboratory and plant trials; basic and complex flotation circuits with examples from recent developments; control in flotation plants: reagents/conditioning. Finally, relevant interfacial surface chemistry is covered: the role of water in flotation; mechanisms and thermodynamics of collector activity.

NSW 700 Welding metallurgy 700
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 48 contact hours per semester
Period of presentation: Year
Language of tuition: English
Credits: 30
Module content:
This module examines the basic physical metallurgy and heat treatment of various metals and alloys, and the application of various mechanical testing techniques, microstructural analysis and corrosion testing to characterise metals and alloys. The structure and properties of welds in carbon steels, stainless steels, cast irons, copper and copper alloys, nickel and nickel alloys, aluminium and aluminium alloys and other materials (Ti, Mg, Ta and Zr) are discussed. Defects are discussed and various techniques to avoid the formation of these defects in welds are considered.

NVM 321 Refractory materials 321
Academic organisation: Materials Science and Metallurgical Engineering
Prerequisite: (NPT 220) and NPM 321 #
Contact time: 1 tpw 2 lpw
Period of presentation: Semester 2
Language of tuition: English
Credits: 8
Module content:
Classification, requirements and properties of refractory materials. Manufacturing principles. Specification and testing of refractory materials. The main refractory systems, i.e. silica, aluminosilicates, alumina, magnesia, magnesia-chrome, magnesia-carbon, doloma, zircon, zirconia, silicon carbide and graphite, and their applications. Principles of ternary phase diagrams and their application in refractory systems, and interactions between slag, metal and refractory materials.

NVM 700 Refractory materials 700
Academic organisation: Materials Science and Metallurgical Engineering
Contact time: 48 contact hours per semester
Period of presentation: Year
Language of tuition: English
Credits: 30
Module content:
The objective is to convey a fundamental understanding of the principles that are involved in the manufacture, selection and use of refractories. Relevant thermodynamic principles are reviewed, with emphasis on the thermodynamic properties of oxide materials, metals and slags, and how these affect refractory performance. Phase diagram use in refractory selection and prediction of slag-metal-refractory interactions is covered. A section on manufacture covers the types of raw materials, design and formulation, handling, manufacturing routes, and quality control (including practical
mineralogy). Finally, design properties of refractories for the ferrous, cement, aluminium, copper, platinum and ferro-alloy industries are reviewed.

**NWM 780 Mathematical modelling of metallurgical processes and materials 780**  
**Academic organisation:** Materials Science and Metallurgical Engineering  
**Contact time:** 48 Contact hours  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 30  
**Module content:**  
This module covers both the theory and practice of mathematical modelling applied to metallurgical processes and materials. The module applies the theory mastered in prior learning such as mathematics, physics, thermodynamics, fluid mechanics, heat transfer, etc. to create mathematical representations of processes and materials. A range of modelling techniques is addressed in the module, such as solution models of solid and liquid mixtures, mass and energy balances, steady state process models, dynamic process models, heat transfer models, computational fluid dynamics models, multiphysics models and technical-economic models. The created models are then applied to solve problems encountered in research and industry.

**NWP 700 Welding processes 700**  
**Academic organisation:** Materials Science and Metallurgical Engineering  
**Contact time:** 48 contact hours per semester  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 30  
**Module content:**  
This module examines arc physics, electrotechnics as applied to weld power sources, and power source design. The fundamental principles, applications, consumables and process variables of various arc welding processes, oxy-gas welding techniques, resistance welding processes, power beam processes and solid-state welding techniques are considered. Brazing and soldering, cutting, surfacing and metal spraying techniques are discussed. The module also looks at the welding of plastics, ceramics and composites, and at the mechanisation and use of robotics in the welding and joining industries. Practical training is included in this module.

**NWP 701 Design of welded structures 701**  
**Academic organisation:** Materials Science and Metallurgical Engineering  
**Contact time:** 48 contact hours per semester  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 30  
**Module content:**  
This module examines welded joint design, the basics of weld design and the role of fracture mechanics in joint design. The behaviour of welded structures under different types of loading are considered, with special focus on the design of welded structures with predominantly static loading and the design of dynamically loaded welded structures. The design of welded pressure equipment, aluminium alloy structures and reinforcing-steel welded joints is considered.

**PEE 410 Mine ventilation engineering 410**  
**Academic organisation:** Mining Engineering  
**Prerequisite:** MTV 310, Finalists only  
**Contact time:** 1 tpw 2 ppw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**
Mine ventilation methods; primary and secondary ventilation methods, ventilation strategies for coal and hard rock mining environments including base metal mines. Mine development ventilation methods, mine air control, different types of fans including fan performances and air dilution calculations. Refrigeration: Elementary refrigeration principles, including concepts and methods, chilled water systems, including cooling distribution methods. Elementary mine ventilation planning, basic planning parameters and elementary mine ventilation economics and the impact of incorrect design and applications on safety and health. Mine gases, their origin and gas/coal dust explosions. Aspects of the Mine Health and Safety act are also dealt with.

PFZ 780 Financial mine valuation 780
Academic organisation: Mining Engineering
Contact time: Self study
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16

PHS 781 Slope stability 781
Academic organisation: Mining Engineering
Contact time: Self study
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16

PJJ 210 Professional and technical communication 210
Academic organisation: Mining Engineering
Contact time: 2 lpw 2 opw
Period of presentation: Semester 1
Language of tuition: English Credits: 8
Module content:
Communicate effectively, both orally and in writing, with engineering audiences and the community at large. Written communication as evidenced by: uses appropriate structure, use of modern or electronic communication methods; style and language for purpose and audience; uses effective graphical support; applies methods of providing information for use by others involved in engineering activity; meets the requirements of the target audience. Effective oral communication as evidenced by appropriate structure, style and language; appropriate visual materials; delivers fluently; meets the requirements of the intended audience. Audiences range from engineering peers, management and lay persons, using appropriate academic or professional discourse. Typed reports range from short (300-1 000 word plus tables diagrams) to long (10 000-15 000 words plus tables, diagrams, references and appendices), covering material at exit level. Methods of providing information include the conventional methods of the discipline, for example engineering drawings, as well as subject-specific methods.

PKB 701 Basic mine ventilation engineering 701
Academic organisation: Mining Engineering
Contact time: Self study
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16

PKB 711 Airflow and fans 711
Academic organisation: Mining Engineering
Contact time: Self study
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16

PKB 712 Heat and refrigeration 712
Academic organisation: Mining Engineering
Contact time: Self study
Period of presentation: Semester 1 or Semester 2
Language of tuition: English  
Credits: 16

PME 320 Mineral economics 320
Academic organisation: Mining Engineering
Contact time: 1 tpw 4 lpw
Period of presentation: Semester 2
Language of tuition: English
Credits: 16

Module content:
The objective is for the student to understand fundamental economic theory pertaining to the mineral and mining industry and its overall effects on the broader South African economy. The student will be able to interpret and understand company annual results. The student should be able to understand and apply the SAMREC/SAMVAL code during the evaluation and classification of resources and reserves. The student should understand the effect of supply and demand pertaining to the mineral and mining industry (micro and macro economic factors). To understand the unique aspects related to marketing of minerals with reference to the cyclic nature of the industry. Apply economic and engineering reasoning to specific problems in the minerals and mining industry so as to analyse and interpret the opportunities and threats facing this industry. To understand and apply the fundamentals of technical mine valuation, including mineral rights, prospecting methods, sampling, mass and mineral content of ore as well as management and control factors. The latter include controlling and managing of widths, stoping width versus tramming and millling width, ore dilution, mine call factor and cut-off grade.

PMY 210 Virtual reality introduction to mining 210
Academic organisation: Mining Engineering
Contact time: 1 tpw 2 lpw
Period of presentation: Semester 2
Language of tuition: English
Credits: 8

Module content:

PMY 311 Surface mining and geotechnics 311
Academic organisation: Mining Engineering
Prerequisite: PMY 210
Contact time: 2 tpw 3 lpw
Period of presentation: Semester 1
Language of tuition: English
Credits: 16

Module content:
Surface mining methods: Introduction, classification of ore reserves and terminology. Earth moving: Loading shovels and methods, haulage trucks, productivity and tires, introduction to bucket wheel excavators, conveyor systems and in-pit crushers, in-pit
crushing-conveying system, application of draglines and terminology. Introduction to mine planning, mine development phases, block modelling, methods of sequencing, stripping ratios and breakeven ratios. Introduction to mining environment, rehabilitation and closure, integrated environmental management, environmental impact studies, water management and rehabilitation planning and costing. Geotechnics include understanding discontinuities in rock mass, stereo nets, cohesion and friction. Rock behaviour pertaining to excavations, understanding plane, circular and wedge failures, Rock slope safety factors. Slope stabilisation, neutral line theory, effects of water in a slope, monitoring of slopes and instruments available for slope stability monitoring. Risk concepts pertaining to slopes and a case study is discussed. Aspects of the Mine Health and Safety Act are also dealt with.

**PMY 320 Mining 320**

**Academic organisation:** Mining Engineering  
**Prerequisite:** PMY 311, PPY 220  
**Contact time:** 2 tpw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Mining 320 provides an overview of mining by covering the following subject-matter: history of mining in South Africa, underground mining systems, and a brief overview of mine environmental control and mine strata control. Then the module covers general mine layouts, mine plan reading, mine surveying, electricity supply, transport systems, water management systems, and mine fires. This feat is achieved through the study of various mining methods and case studies.

**PMY 410 Mining 410**

**Academic organisation:** Mining Engineering  
**Prerequisite:** PRX 321, PME 320, PMY 320, Finalists only  
**Contact time:** 1 tpw 2 ppw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  

**PMY 423 Mine Operational Risk Management 423**

**Academic organisation:** Mining Engineering  
**Prerequisite:** Finalists only  
**Contact time:** 1 dpw 2 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 8  
**Module content:**  
Selected topics in operational risk management; Introduction and context; Risk management concepts, words and models; Risk assessment principles; Human factors; Leading practice; Layered risk management (including identification, assessment and control); Scoping risk assessments; Integrating outcomes into the business; ORM journey tool; Line management and OR; Safety and Mineral Statistical Structures and Codes; Legal aspects.
PMY 701 Underground mining methods 701  
**Academic organisation:** Mining Engineering  
**Contact time:** 10 lpw  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
PMY 701 provides an overview of mining by covering the following subject matter: history of mining in South Africa, surface-mining methods, underground mining methods, and a brief overview of mine environmental control and mine strata control. Then the module covers general mine layouts, mine plan reading, mine surveying, electricity supply, transport systems, water management systems, and mine fires. Specific mining techniques. Shafts: Types, methods and equipment for sinking; economic considerations. Tunnelling: Design, development techniques and equipment. Design and construction of large excavation. Design, construction, reinforcing and repair of ore passes. Fires in gold and coal mines: Causes, prevention, detection, combating and insurance. Flooding: Water sources, results, dangers, sealing and control.

PMY 703 Surface-mining 703  
**Academic organisation:** Mining Engineering  
**Contact time:** 10 lpw  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Mining methods for open pits and strip mine operations. Basic mine planning, scheduling and economic cut-off limits with regards to waste stripping and ore grade. Continuous and discontinuous operations: Selection and management of truck-based loading and transport systems. Selection and management of conveyor-based loading and transport systems. Dragline selection, operation, management and strip mining practices. Slope stability in surface mines, plane, wedge and circular/non-circular failures.

PMZ 422 Mine design and research 422  
**Academic organisation:** Mining Engineering  
**Prerequisite:** PMY 410, PSZ 410, PEE 410. PNB 400, Finalists only  
**Contact time:** 4 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 42  
**Module content:**  
This module entails the completion of an engineering project from concept to delivery. The student must demonstrate mastery of a mining engineering project. The module focusses on the formulation of a mining engineering problem, the development of appropriate extraction methodologies, project planning and management and then completion of a technical project of a given nature, scope and complexity. Students are required to design a mine at the conceptual business case level. Students are given a surface plan and borehole data from which they have to design a mine in teams of 3 – 5 students. They have access to a mining engineer in industry to assist with advice. The design has to incorporate a market analysis, layout design, environmental impacts and financial analysis. The design is submitted in book form and each team member has to do a presentation of the design.

PMZ 780 Advanced design: Mining 780  
**Academic organisation:** Mining Engineering
Contact time: Self study
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16

PNB 300 Industrial excursions 300
Academic organisation: Mining Engineering
Contact time: 3 ppw
Period of presentation: Year
Language of tuition: English Credits: 8

Module content:
The mining industry requires that students are exposed to the mining industry by visiting a collection of mines with the purpose of familiarising them with current trends in mining practice and mining methods. This module hopes to provide a “snapshot” of the mining industry as it is at the time of the tour. This tour requires attendance and participation in five one-day visits to mines. The excursions are organised during the first semester of the third year, and take place during the July recess at the end of the semester. Students are expected to submit a group report on the visits during the second semester.

PNB 400 Industrial excursions 400
Academic organisation: Mining Engineering
Prerequisite: PNB 300, Finalists only
Contact time: 3 ppw
Period of presentation: Year
Language of tuition: English Credits: 8

Module content:
Attendance of and participation in industrial excursions organised during the year, including a ten-day excursion tour at the end of the first semester. Submission of reports and assignments as required.

POY 783 Open-pit mining 783
Academic organisation: Mining Engineering
Contact time: Self study
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16

PPY 220 Experiential training 220
Academic organisation: Mining Engineering
Period of presentation: Semester 2
Language of tuition: English Credits: 16

Module content:
The student needs to undergo practical mine training for a period of at least 6 weeks to be exposed to the mining environment, a report on this vacation work will be expected as per department guideline, in English only.

PPY 320 Experiential training 320
Academic organisation: Mining Engineering
Period of presentation: Semester 2
Language of tuition: English Credits: 16

Module content:
The mining industry requires students to become exposed to mining by working on mines during the December recess period at the end of the second academic year. The student is required to work for a minimum period of six weeks on a mine, and then compile a report on the work completed for submission at a prescribed date in the first
semester of the third academic year.

PRX 321 Explosives engineering 321
Academic organisation: Mining Engineering
Prerequisite: MTX 221
Contact time: 2 tpw 3 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 8
Module content:
Explosive engineering: The importance of improved safety standards, cost effectiveness and productivity has driven technical mining personnel to examine all facets of their operations. Increasingly, it has been realized that an efficient drilling and blasting program will impact positively throughout the mining operation, from loading to maintenance, hauling to crushing, ground support to scaling and grade control to recover with an invariable increase in the overall profitability through technical advanced projects. Through the safe, efficient and innovative use of explosives for rock breaking the mining engineer will make a positive contribution to the overall mining operation. Due to the nature of the topics discussed in this module, a number of case studies are used to emphasise the safe handling, application and destruction of explosives. The Mine Health and Safety Act is dealt with and the Explosives Act receives specific attention.

PRX 701 Explosives engineering 701
Academic organisation: Mining Engineering
Contact time: 10 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16
Module content:
History of explosives, types of explosives: primary and secondary explosives, thermodynamics of detonation, strength of explosives. Methods and techniques, explosive initiating systems, application of explosives in rock breaking; the effects of geology and drilling. Surface and underground blasting, controlled blasting, vibration control, air blast. Ethics and regulatory compliance. Equipment and calculations.

PRX 785 Advanced explosive engineering 785
Academic organisation: Mining Engineering
Contact time: Self study
Period of presentation: Semester 1 or Semester 2
Language of tuition: English Credits: 16
Module content:
Types of commercial explosives. Properties of explosives. Explosive initiating systems, application of explosives in rock breaking; Surface and underground blast designs and specialised blast designs; the effects of geology on blast results. Fragmentation, blasting and environmental control. Blast assessment. Ethics and regulatory compliance. Safety in blasting.

PSC 321 Introduction to project 321
Academic organisation: Mining Engineering
Prerequisite: PNB 300
Contact time: 1 tpw 2 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 8
Module content:
Reporting technical information: typical report structure, literature survey, data
presentation (tables, graphs, diagrams), referencing, presenting results, conclusions, and recommendations. Identification of a suitable subject for the Final Year Project. Planning of project execution.

**PSC 411 Project 411**
**Academic organisation:** Mining Engineering  
**Prerequisite:** PSC 321, Finalists only  
**Contact time:** 1 tpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 10  
**Module content:**  
The project involves the execution of an analytical and/or experimental research project under guidance of a lecturer. During the second semester of the third year of study students must select a suitable research topic, to be approved by the head of department. Data for the approved project will be collected during the practical training period during the summer recess at the end of the third year of study. A comprehensive and detailed project report must be compiled and submitted for evaluation at a prescribed date in the first semester of the fourth year. The student must also prepare a presentation of the project for an oral examination at the end of the semester.

**PSS 700 Guided special studies 700**  
**Academic organisation:** Mining Engineering  
**Contact time:** Self study  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 32  

**PSZ 410 Strata control 410**  
**Academic organisation:** Mining Engineering  
**Prerequisite:** SWK 210, PMY 320, Finalists only  
**Contact time:** 1 tpw 2 ppw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Three dimensional stress and strain tensors and linear elasticity. The state of stress in the earth’s crust. Rock material and rock mass failure criteria. The response of the rock mass to underground excavations, energy release rate and excess shear stress. Mining induced seismicity, rock bursts and measures to minimise mining induced seismicity so as to improve SHE. Elementary mine layout design, pillar design and underground excavation support and their effects on SHE. Stress analysis of mining layouts and mine layout optimisation.

**PSZ 703 Basic rock mechanics 703**  
**Academic organisation:** Mining Engineering  
**Contact time:** Self study  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  

**PSZ 786 Strata control: Hard-rock mining 786**  
**Academic organisation:** Mining Engineering  
**Contact time:** Self study  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16  

**PSZ 788 Strata control: Collieries 788**  
**Academic organisation:** Mining Engineering
Contact time: Self study  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 16

**PWP 121 Workshop practice 121**  
**Academic organisation:** Mining Engineering  
**Contact time:** 1 opw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 8

**Module content:** *Attendance modules only*

The modules are presented during the first year of study and, subject to departmental arrangements, can be attended either during July or December holiday periods. The duration will be a minimum of two weeks, during which time the student will receive training in a mine as well as a mine workshop. Training will include the following maintenance aspects: rotary and percussion drills, transport equipment, hoists and hoist ropes, electrical motors, conveyor belts and pumps. A satisfactory report must be submitted within two weeks after the commencement of lectures of the following semester.

**PYI 890 Dissertation: Mining engineering 890**  
**Academic organisation:** Mining Engineering  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 180

**PYI 891 Dissertation 891**  
**Academic organisation:** Mining Engineering  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 180

**SBM 321 Civil building materials 321**  
**Academic organisation:** Civil Engineering  
**Prerequisite:** SGM 221  
**Contact time:** 1 tpw 2 ppw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16

**Module content:**
The behaviour, properties and application of cement and concrete products, structural steel, fibre reinforcing, polymers, masonry work and bituminous materials.

**SBZ 221 Civil engineering measurement techniques 221**  
**Academic organisation:** Civil Engineering  
**Prerequisite:** (SWK 210)  
**Contact time:** 1 ppw 2 lpw 3 tpw  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 8

**Module content:**

**SBZ 420 Civil engineering construction management 420**
Engineering 2017

Academic organisation: Civil Engineering
Prerequisite: (SVC 412)
Contact time: 1 ppw 1 tpw 4 lpw
Period of presentation: Semester 2
Language of tuition: English

Module content:

SCA 420 Computer applications in civil engineering 420
Academic organisation: Civil Engineering
Prerequisites: (SHC 410) (SIN 411) (SIN 413) (SGM 323) (SVC 412)
Contact time: 2 ppw 2 tpw 3 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng

Module content:
In this module commercially available computer packages will be used to develop models based on Finite Elements, Finite Differences and other approaches. Limitations and simple checks to ensure consistency of commonly used design software packages will be illustrated. Basic principles and techniques will be discussed and the effect of aspects such as meshing, element choice, boundary conditions and material properties will be investigated. Applications within the various fields of Civil Engineering will be considered. Results obtained from models will be compared to actual experimental results. This module will contain groupwork and multi-disciplinary problems will be solved.

SDO 420 Detailed design 420
Academic organisation: Civil Engineering
Prerequisite: (SHC 410), (SIN 411), (SIN 413), (SGM 323), (SVC 412)
Contact time: 1 ppw 1 tpw 5 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng

Module content:
The module focuses on design applications. The student is exposed to the application of the classic disciplines of structures, geotechnical, hydraulics and transportation in detail design. Supervisors select the most valuable application in each discipline. Typical examples include the following:
- Structures: Multi storey buildings with reinforced concrete frames and slabs
- Hydraulics: Pump lines and stations
- Geotechnical: Slimes dams
- Transportation: Traffic impact studies, pavement design and analysis
The applications selected for each discipline may vary from year to year.

SEV 421 Environmental geotechnology 421
Academic organisation: Civil Engineering
Contact time: 1 ppw 1 tpw 4 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng

Module content:

SGC 793 Pavement design 793
**Academic organisation:** Civil Engineering
**Contact time:** 40 Contact hours
**Period of presentation:** Year
**Language of tuition:** English
**Credits:** 24

**Module content:**
Design philosophy in First and Third World environments; characterising and use of pavement materials; drainage; systems approach to layout, geometric and pavement design; stresses and strains in pavements; mechanistic design methods and elasto-plastic behaviour; economic analysis; designing pavements for streets, gravel and paved roads, runways, and industrial areas. Report writing. A research term paper will be prepared.

SGC 794 Concrete technology 794
**Academic organisation:** Civil Engineering
**Contact time:** 40 Contact hours
**Period of presentation:** Year
**Language of tuition:** English
**Credits:** 24

**Module content:**

SGC 797 Road rehabilitation technology 797
**Academic organisation:** Civil Engineering
**Contact time:** 40 Contact hours
**Period of presentation:** Year
**Language of tuition:** English
**Credits:** 24

**Module content:**

SGI 890 Dissertation 890
**Academic organisation:** Civil Engineering
**Period of presentation:** Year
**Language of tuition:** English
**Credits:** 180
SGM 210 Geomaterials and processes 210  
**Academic organisation:** Civil Engineering  
**Contact time:** 4 lpw 3 ppw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  
Solar system; Earth structure and systems; plate tectonics; classification and contextual setting of rocks and minerals; rock cycle. Internal and external geological processes; landscape formation; influences of geological environment on mankind. Geological time and the Earth’s history through time. Practicals involving identification and description of crystals, minerals and rocks.

SGM 221 Pavement materials and design 221  
**Academic organisation:** Civil Engineering  
**Prerequisite:** SGM 210 GS  
**Contact time:** 1 tpw 2 lpw 2 ppw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  

SGM 311 Soil mechanics 311  
**Academic organisation:** Civil Engineering  
**Prerequisite:** (SWK 210)  
**Contact time:** 1 tpw 2 ppw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  

SGM 323 Geotechnical engineering 323  
**Academic organisation:** Civil Engineering  
**Prerequisite:** (SGM 311)  
**Contact time:** 1 ppw 2 dpw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  
Application of consolidation theory. Bearing capacity of soil and foundation design, Terzaghi and general methods. Horizontal stresses in soil and design of retaining structures, Rankine and Coulomb’s methods. Slope stability including Bishop’s method of slices. Introduction to site investigation.

SGM 785 Basic soil mechanics 785  
**Academic organisation:** Civil Engineering  
**Contact time:** 20 Contact hours  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 24  
**Module content:**
Introduction to soil mechanics, classification of soil characteristics, seepage and permeability, stress and strain in saturated and partially saturated soils, Mohr’s circle applications.

SGM 787 Basic pavements and transportation 787
Academic organisation: Civil Engineering
Contact time: 40 Contact hours
Period of presentation: Year
Language of tuition: English Credits: 24
Module content:
Pavements: The geological cycle and origin of road building materials, soil testing and classification systems, compaction, stabilization, bitumen, introduction to pavements, principles of pavement design and management.
Transportation: Introduction to traffic analysis techniques, capacity and level of service concepts, traffic signal design, road geometric design, transport demand models and road safety engineering.

SGS 787 Analytical soil mechanics 787
Academic organisation: Civil Engineering
Contact time: 20 Contact hours
Period of presentation: Year
Language of tuition: English Credits: 24
Module content:

SGS 788 Theoretical soil mechanics 788
Academic organisation: Civil Engineering
Contact time: 20 Contact hours
Period of presentation: Year
Language of tuition: English Credits: 24
Module content:

SGS 789 Specialised geotechnical testing 789
Academic organisation: Civil Engineering
Contact time: 32 Contact hours
Period of presentation: Year
Language of tuition: English Credits: 24
Module content:
Test procedures and interpretation of; Standard Penetration Test (SPT), Cone Penetration Test (CPT), Piezocone (CPTU) and seismic methods. Theory, application and interpretation of advanced geotechnical laboratory tests. Laboratory Instrumentation and calibration. Stress and strain conditions for laboratory tests. Triaxial stress space, stress paths. Triaxial tests, direct shear tests, oedometer test and Rowe cell test. A research term paper will be prepared.

SHC 310 Hydraulics 310
Academic organisation: Civil Engineering
Prerequisite: (SWK 210)
Contact time: 1 dpw 1 ppw 4 lpw
Period of presentation: Semester 1
Language of tuition: Double Medium
Credits: 16
Module content:

SHC 321 Hydraulics 321
Academic organisation: Civil Engineering
Prerequisite: (SHC 310)
Contact time: 1 ppw 1 tpw 4 lpw
Period of presentation: Semester 2
Language of tuition: Double Medium
Credits: 16
Module content:

SHC 410 Hydraulics 410
Academic organisation: Civil Engineering
Prerequisite: (SHC 310), SHC 321 GS
Contact time: 1 ppw 1 tpw 4 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng
Credits: 16
Module content:
Sediment transportation, hydraulic structures, bridges and culvert hydraulics, stormwater handling. Hydrology, flood hydrology, creation of runoff records and the simulation of surface water resources, creation of stochastic sequences and the reliability analysis of surface water resources.

SHC 792 Flood hydrology 792
Academic organisation: Civil Engineering
Contact time: 32 Contact hours
Period of presentation: Year
Language of tuition: English
Credits: 24
Module content:
This course entails the calculation of design flows for different return periods, using the statistical, deterministic – and empirical methods. Dambreak analysis is included in this course as well as channel and level pool routing. A research term paper will be prepared.

SHC 793 Hydraulic design 793
Academic organisation: Civil Engineering
Contact time: 32 Contact hours
Period of presentation: Year
Language of tuition: English
Credits: 24
Module content:
This course covers the hydraulic aspects associated with the design of hydraulic structures for dams, road drainage, and other conveyance systems. The hydraulic considerations for the selection and design of energy dissipation structures are assessed in this course. A research term paper will be prepared.
SHC 794 Free surface flow 794
Academic organisation: Civil Engineering
Contact time: 32 Contact hours
Period of presentation: Year
Language of tuition: English  
Credits: 24
Module content:
This course entails the calculation of design flows for different return periods, using the statistical, deterministic – and empirical methods. Dambreak analysis is included in this course as well as channel and level pool routing. A research term paper will be prepared.

SHC 795 Pipe flow 795
Academic organisation: Civil Engineering
Contact time: 40 Contact hours
Period of presentation: Year
Language of tuition: English  
Credits: 24
Module content:
The focus in this course will be on the practical aspects of pipeline design. The theoretical background to pipeline hydraulics will be covered and practical examples will be assessed. The following specific aspects such as pipeline hydraulics included dynamic pressures, pipeline component selection and design, pipeline installation and the testing and operation of pipelines will be covered in this course. A research term paper will be prepared.

SHC 796 Water resource analysis and management 796
Academic organisation: Civil Engineering
Contact time: 32 Contact hours
Period of presentation: Year
Language of tuition: English  
Credits: 24
Module content:
In this course students will be familiarized with the background and procedures used in the creation of flow records and the use of the WRSM2005 model. Surface water systems will be analysed and gross yields will be determined. In the second part of the course the theory and procedures required for the yield determination of surface water resources will be discussed. A research term paper will be prepared.

SHC 797 Basic statistical methods 797
Academic organisation: Civil Engineering
Contact time: 40 Contact hours
Period of presentation: Year
Language of tuition: English  
Credits: 24
Module content:

SHC 798 Applied statistical methods and optimisation 798
Academic organisation: Civil Engineering
Contact time: 40 hours per year
Period of presentation: Year
Language of tuition: English  
Credits: 24
**Module content:**
The course will apply some of the basics theories and methodologies in statistics and operations research to solve common civil engineering problems. The course seeks to demonstrate the use and application in the civil engineering field. Each of the applications seeks to determine how best to design and operate a system, usually under conditions requiring the allocation of scarce resources. Emphasis will be on the applications of these methods in common civil engineering practice. Some of the applications will include; optimum network design, maximum flow problem, project scheduling, queuing theory, probabilistic analysis, Markov chain applications, etc. A research term paper will be prepared.

**SHW 785 Pump systems 785**
*Academic organisation:* Civil Engineering
*Contact time:* 32 Contact hours
*Period of presentation:* Year
*Language of tuition:* English
*Credits:* 24

**Module content:**
A research term paper will be prepared.

**SHW 788 Basic hydraulics 788**
*Academic organisation:* Civil Engineering
*Contact time:* 28 Contact hours
*Period of presentation:* Year
*Language of tuition:* English
*Credits:* 24

**Module content:**
This course covers the basic hydraulic principles and their application. Themes covered include: fluid characteristics, fluid kinematics, pipe flow, pipe networks, introduction to pumps and pump stations, free surface flow, flow measurement, hydraulic assessment of hydraulic structures, storm water drainage and culvert systems and flood hydrology.

**SIB 310 Timber design 310**
*Academic organisation:* Civil Engineering
*Prerequisite:* SIN 223 GS
*Contact time:* 1 tpw 2 lpw
*Period of presentation:* Semester 1
*Language of tuition:* Both Afr and Eng
*Credits:* 8

**Module content:**
Self-weight, imposed and wind loads. Principles of limit-states design. Timber as a structural material, design of tension, compression and bending members (laterally braced and unbraced), beam columns, trusses and bracing.

**SIC 790 Basic structural analysis 790**
*Academic organisation:* Civil Engineering
*Contact time:* 40 Contact hours
*Period of presentation:* Year
*Language of tuition:* English
*Credits:* 24

**Module content:**
Virtual work and influence lines, analysis of statically indeterminate structures (two and three-dimensional), slope-deflection, superposition, stiffness and flexibility methods, matrix and computer methods, plastic analysis of portal frames.

**SIC 793 Basic structural design 793**
*Academic organisation:* Civil Engineering
*Contact time:* 40 Contact hours
Period of presentation: Year
Language of tuition: English Credits: 24
Module content:
This course comprises two sections: reinforced concrete design and structural steel design.
Reinforced concrete design covers the design of beams; behaviour and design of slabs; design of slender columns and columns subjected to bi-axial bending; design of simple and combined footings; staircase design; and an introduction to prestressed concrete.
Structural steel design covers the characteristics of steel; design of structural steel members including elements in bending, and bending combined with tension and compression; design of portal frames; composite construction and the bending resistance of composite sections; and plastic design.

SIE 310 Civil engineering economics 310
Academic organisation: Civil Engineering
Contact time: 2 lpw 2 opw
Period of presentation: Semester 1
Language of tuition: English Credits: 8
Module content:
Introduction to engineering economics: Basic guidelines, assessment of alternative investment possibilities. Equal annual cash flow, current value, internal rate of return, cost benefit relationship.
Economic evaluation of projects: Influence of depreciation on the economics of projects, determination of income tax implications of decisions, economic analysis of multiple alternatives, the influence of inflation on the economics of projects, application of the theory of probability for economics studies, economic studies on the replacement of equipment.

SIK 790 Numerical methods and finite element applications for Civil Engineers 790
Academic organisation: Civil Engineering
Contact time: 40 Contact hours
Period of presentation: Semester 1 and Semester 2
Language of tuition: English Credits: 24
Module content:
In the first part of this course, numerical procedures and some underlying theory for solving systems of equations, eigenvalue problems, integration, approximation and boundary value problems will be discussed. The second part of the course covers general finite element theory, discretization aspects related to geometry, nodes and numbering, element type and shape, interpolation functions, formulation of element characteristic matrices and vectors for elasticity problems, assembly and solution of the finite element equations, modelling procedures and results processing. The student will use Finite Element software to apply the theory that was covered in the course for solving typical Civil Engineering problems.

SIN 223 Structural analysis 223
Academic organisation: Civil Engineering
Prerequisite: SWK 210, WTW 164/WTW 161, WTW 168
Contact time: 1 tpw 2 ppw 3 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng Credits: 16
Module content:
Statically indeterminate beams. Euler buckling of columns with different boundary
conditions. Virtual work. Analysis of statically indeterminate structures using the methods of super-position, slope-deflection and moment distribution (with sway and support displacement).

**SIN 311 Structural analysis 311**
**Academic organisation:** Civil Engineering
**Prerequisite:** SIN 223
**Contact time:** 1 ppw 1 t pw 2 lpw
**Period of presentation:** Semester 1
**Language of tuition:** Both Afr and Eng
**Credits:** 8

**Module content:**
Analysis of symmetrical structures using slope-deflection equations or moment-distribution; three dimensional structures and grillages; plastic analysis of frames; matrix methods; influence lines.

**SIN 323 Steel design 323**
**Academic organisation:** Civil Engineering
**Prerequisite:** SIN 311 GS
**Contact time:** 1 ppw 1 t pw 2 lpw
**Period of presentation:** Semester 2
**Language of tuition:** Both Afr and Eng
**Credits:** 8

**Module content:**

**SIN 324 Reinforced concrete design 324**
**Academic organisation:** Civil Engineering
**Prerequisite:** SIN 311 GS
**Contact time:** 1 ppw 1 t pw 2 lpw
**Period of presentation:** Semester 2
**Language of tuition:** Both Afr and Eng
**Credits:** 8

**Module content:**

**SIN 325 Structural concrete 325**
**Academic organisation:** Civil Engineering
**Prerequisite:** SIN 223
**Contact time:** 1 ppw 1 t pw 4 lpw
**Period of presentation:** Semester 1
**Language of tuition:** Both Afr and Eng
**Credits:** 16

**Module content:**
Properties of reinforced concrete. Principles of limit states design. Analysis and design of sections in flexure and in compression combined with flexure. Design for shear and torsion. Bond and anchorage. Serviceability requirements: Detailing and span-effective depth ratios. Design of footings and short columns. Behaviour and design of beams, slabs (solid, ribbed and waffle slabs, flat plates and flat slabs), columns (slender columns and biaxial bending), footings (simple and combined footings) and stairs. Introduction to the design of prestressed concrete flexural members.

**SIN 411 Steel design 411**
Academic organisation: Civil Engineering
Prerequisite: (SIN 323)
Contact time: 1 ppw 1 tpw 2 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng
Credits: 8
Module content:
Analysis and design composite steel beam and concrete slab construction, Moment connections, Elastic and plastic design of portal, industrial and building structures.

SIN 413 Reinforced concrete design 413
Academic organisation: Civil Engineering
Prerequisite: (SIN 324)
Contact time: 1 ppw 1 tpw 2 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng
Credits: 8
Module content:
Behaviour and design of beams, slabs (solid, ribbed and waffle slabs, flat plates and flat slabs), columns (slender columns and biaxial bending), footings (simple and combined footings) and stairs. Introduction to the design of prestressed concrete flexural members.

SIN 415 Structural steel 415 (Only presented from 2018)
Academic organisation: Civil Engineering
Prerequisite: (SIN 323) (SIN 325)
Contact time: 1 ppw 1 tpw 4 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng
Credits: 16
Module content:
Analysis and design composite steel beam and concrete slab construction, Moment connections, Elastic and plastic design of portal, industrial and building structures.

SIN 776 Steel design 776
Academic organisation: Civil Engineering
Contact time: 40 Contact hours
Period of presentation: Year
Language of tuition: English
Credits: 24
Module content:
Introduction to structural reliability, tension elements, buckling of plates in compression elements, compression elements, beams and plate girders, plastic analysis and design of structures and structural elements, connections, composite design and steel-framed structures. A research term paper will be prepared.

SIN 777 Structural mechanics 777
Academic organisation: Civil Engineering
Contact time: 40 Contact hours
Period of presentation: Year
Language of tuition: English
Credits: 24
Module content:
SIN 778 Reinforced concrete design 778  
**Academic organisation:** Civil Engineering  
**Contact time:** 40 Contact hours  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 24  
**Module content:**  
Material properties. Behaviour and analysis of reinforced concrete members for flexure, axial loads, flexure plus axial load and shear. Cracking and deflection (short- and long-term) of flexural members. Plasticity in flexural members. Braced and unbraced slender columns. A research term paper will be prepared.

SIN 779 Timber design 779  
**Academic organisation:** Civil Engineering  
**Contact time:** 40 Contact hours  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 24  
**Module content:**  
Timber properties, grading, treatment, structural form, element design and bracing of structures. Analysis of I-beams, composite beams, frames and connections. Research project. A research term paper will be prepared.

SIN 790 Structural analysis 790  
**Academic organisation:** Civil Engineering  
**Contact time:** 40 Contact hours  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 24  
**Module content:**  
Stiffness and flexibility methods for plane, grid and three-dimensional structures. In-plane stability of beam-columns and frames; effective lengths and lateral torsional instability of beams. Dynamics: free and forced, undamped and damped framed systems and mass matrices and natural frequencies. A research term paper will be prepared.

SIN 791 Pre-stressed concrete design 791  
**Academic organisation:** Civil Engineering  
**Contact time:** 40 Contact hours  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 24  
**Module content:**  
Material properties; prestressing systems; flexural design; losses; effects of continuity; shear; deflections; anchorage; cracking; prestressed concrete slabs and detailing. A research term paper will be prepared.

SIN 890 Dissertation: Structural engineering 890  
**Academic organisation:** Civil Engineering  
**Period of presentation:** Year  
**Language of tuition:** Both Afr and Eng  
**Credits:** 180

SIR 990 Thesis: Civil engineering 990  
**Academic organisation:** Civil Engineering  
**Period of presentation:** Year  
**Language of tuition:** Both Afr and Eng  
**Credits:** 360

SJJ 210 Professional and technical communication 210
Academic organisation: Civil Engineering  
Contact time: 2 lpw 2 opw  
Period of presentation: Semester 1  
Language of tuition: English  
Credits: 8

Module content:  
Communicate effectively, both orally and in writing, with engineering audiences and the community at large. Written communication as evidenced by: uses appropriate structure, use of modern or electronic communication methods; style and language for purpose and audience; uses effective graphical support; applies methods of providing information for use by others involved in engineering activity; meets the requirements of the target audience. Effective oral communication as evidenced by appropriate structure, style and language; appropriate visual materials; delivers fluently; meets the requirements of the intended audience. Audiences range from engineering peers, management and lay persons, using appropriate academic or professional discourse. Typed reports range from short (300-1 000 word plus tables diagrams) to long (10 000-15 000 words plus tables, diagrams, references and appendices), covering material at exit level. Methods of providing information include the conventional methods of the discipline, for example engineering drawings, as well as subject-specific methods.

SPY 410 Practical training 410  
Academic organisation: Civil Engineering  
Contact time: 1 opw  
Period of presentation: Semester 1  
Language of tuition: Both Afr and Eng  
Credits: 16

Module content: *Attendance module only  
During or at the end of the third year of study, students in civil engineering undergo at least 6 weeks of prescribed training in the industry. A satisfactory report on the practical training must be submitted to the Student Administration within one week of registration.

SSC 412 Research project 412  
Academic organisation: Civil Engineering  
Prerequisite: (SHC 321) (SIN 323) (SIN 324) (SGM 323) (SBM 321) (SVC 323)  
Contact time: 2 tpw 6 ppw  
Period of presentation: Semester 1  
Language of tuition: Both Afr and Eng  
Credits: 30

Module content:  
In the first semester, two full days of the week must be used by final-year students for the execution of an analytical and/or experimental research project.

SSC 780 Civil research (compulsory module) 780  
Academic organisation: Civil Engineering  
Contact time: 8 hours lectures per year, remainder research  
Period of presentation: Semester 1 and Semester 2  
Language of tuition: English  
Credits: 32

Module content:  
The course will require all honours students to conduct research in an appropriate field of civil engineering, linked to the main discipline in which the student specializes for their honours degree.

SSI 790 Infrastructure management 790  
Academic organisation: Civil Engineering  
Contact time: 40 Contact hours  
Period of presentation: Year  
Language of tuition: English  
Credits: 24
Module content:
This module will cover the following topics: Asset Management principles, Maintenance Management principles, Maintenance strategies and philosophies, Condition based Maintenance, Reliability Centred Maintenance (RCM), Resource Management, Maintenance Management Systems, Total Productive Maintenance (TPM) and Risk Management. Maintenance management of the following disciplines will be studied in detail: Road infrastructure, Railway infrastructure, Airport infrastructure, Buildings and other structures, Water resources and water supply. A research term paper will be prepared.

SST 890 Dissertation 890
Academic organisation: Civil Engineering
Period of presentation: Year
Language of tuition: English Credits: 180

SVC 323 Transportation engineering 323
Academic organisation: Civil Engineering
Prerequisite: BES 220
Contact time: 2 tpw 4 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng Credits: 16
Module content:
Introduction to transportation engineering; vehicle performance and motion; traffic analysis techniques; traffic data collection; capacity and level of service analysis; railway engineering; airport capacity; geometric road design; cross-section, horizontal and vertical alignment; urban streets; layout considerations and intersection design; traffic control; traffic safety.

SVC 412 Infrastructure planning 412
Academic organisation: Civil Engineering
Prerequisite: SIE 310/BIE 310
Contact time: 2 ppw 4 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng Credits: 16
Module content:
Introduction to the basic concepts of urban and regional planning. The planning process, policy and institutional framework in which planning functions in SA. The interaction and co-operation of land and space, economy, politics and social aspects related to space in decision making. Interventions for sustainable development planning and design; definitions and rationale for land-use management and the strategic integrated development planning process. Infrastructure system evaluation, risk assessment, feasibility and decision analysis. Life cycle costing of infrastructure. Demand and supply analysis. Demand forecasting models.

SVC 789 Transportation planning 789
Academic organisation: Civil Engineering
Contact time: 40 Contact hours
Period of presentation: Year
Language of tuition: English Credits: 24
Module content:
Introduction to transport planning processes and institutions in S.A. Introduction to contemporary issues in land use/transport planning (including in urban transport; rural transport; air transport; energy and environment). Social, economic, and political impacts and dependencies of transport. Project evaluation, discounting, inflation,

**SVC 790 Transportation studies 790**

**Academic organisation:** Civil Engineering  
**Contact time:** 40 Contact hours  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 24

**Module content:**  
Basic transportation relationships, land use, data collection and surveys. Four step transportation model, trip generation, trip distribution, modal split, trip assignment, advanced modelling approaches. Introduction to discrete choice models, econometrics, and stated preference analysis. Role of transport modelling in developmental context. A research term paper will be prepared.

**SVC 791 Transportation special 791**

**Academic organisation:** Civil Engineering  
**Contact time:** 40 Contact hours  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 24

**Module content:**  
Basic transportation relationships, land use, data collection and surveys. Four step transportation model, trip generation, trip distribution, modal split, trip assignment, advanced modelling approaches. Introduction to discrete choice models, econometrics, and stated preference analysis. Role of transport modelling in developmental context. A research term paper will be prepared.

**SVC 792 Traffic engineering 792**

**Academic organisation:** Civil Engineering  
**Contact time:** 40 Contact hours  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 24

**Module content:**  

**SVI 890 Dissertation 890**

**Academic organisation:** Civil Engineering  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 180

**SVV 788 Multimodal transport 788**

**Academic organisation:** Civil Engineering  
**Contact time:** 40 Contact hours  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 24

**Module content:**  
The role of public transport in cities; theory and principles of public transport network design, scheduling and operations; terminals; public transport modes; costs, fares and subsidies; contemporary issues and approaches to public transport restructuring and
formalisation in South Africa, including Bus Rapid Transit (BRT). Planning and designing for non-motorised transport, including pedestrians, bicyclists, and animal-drawn transport. A research term paper will be prepared.

SVV 791 Geometric design and safety 791
Academic organisation: Civil Engineering
Contact time: 40 Contact hours
Period of presentation: Year
Language of tuition: English  Credits: 24
Module content:
Rural/Peri-urban road networks: transportation policy, standards and safety, environmental quality, capacity, design, interchanges. Urban street networks: functional classes, town planning considerations, capacities, environment, safety, standards design, evaluation of road networks.
Traffic safety in global and national content, Road Safety Engineering and the assessment and interpretation of accident information, reactive and proactive identification of remedial measures, traffic safety strategies: 3E model and Haddon matrix. A research term paper will be prepared.

SWK 122 Mechanics 122
Academic organisation: Civil Engineering
Prerequisite: WTW 158
Contact time: 2 tpw 4 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: Both Afr and Eng Credits: 16
Module content:

SWK 210 Strength of materials 210
Academic organisation: Civil Engineering
Prerequisite: Faculty of Engineering, Built Environment and Information Technology: SWK 122 and WTW 164 OR SWK 122, WTW 161 and WTW 168. Faculty of Natural and Agricultural Sciences: SWK 122 and WTW 124 OR SWK 122, WTW 126 and WTW 128.
Contact time: 2 tpw 4 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng Credits: 16
Module content:
Stresses, strains and the mechanical properties of materials: Normal stress and shear stress, tension and compression, equilibrium in shear, factor of safety, design, shear strain, stress/strain diagram, Hooke's Law, Poisson's Ratio and the shear stress/strain diagram. Axial loads: Elastic deformation, displacements, statically determinate and indeterminate structures and thermal effects. Torsion: Torsion of circular bars and power transmission bending of straight members and composite beams. Transverse shear: Shear in straight members and shear flow. Combined loads: Thin walled pressure vessels and stresses as a result of combined loads. Stress transformation: Plane stress transformation, principle stresses, maximum values and stress variation in

**SWK 211 Statics 211**  
**Academic organisation:** Civil Engineering  
**Prerequisite:** SWK 122  
**Contact time:** 1 ppw 2 lpw 3 tpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  

**SWP 121 Workshop practice 121**  
**Academic organisation:** Civil Engineering  
**Contact time:** 1 opw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 6  
**Module content:**  
The module is offered at the end of the first year of study and lasts at least eight days during which the students receive training in the following workshops: formwork, scaffolding, masonry, welding and structural steel.

**WAI 780 Industrial waste engineering 780**  
**Academic organisation:** Chemical Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1 or Semester 2  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  

**WAI 787 Industrial waste engineering 787**  
**Academic organisation:** Chemical Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 2  
**Language of tuition:** English  
**Credits:** 32  
**Module content:**  
Identification of source materials, physical and chemical properties of waste. Release and transport mechanisms from source to air, groundwater, soil. Primary pathways of

**WBK 890 Dissertation: Water resource engineering 890**
- **Academic organisation:** Civil Engineering
- **Period of presentation:** Year
- **Language of tuition:** Both Afr and Eng
- **Credits:** 180

**WBW 780 Biological water treatment 780**
- **Academic organisation:** Chemical Engineering
- **Contact time:** 32 contact hours per semester
- **Period of presentation:** Semester 1
- **Language of tuition:** English
- **Credits:** 32
- **Module content:** Composition and characterisation of sewage; Basic design principles of: Simple sewage treatment systems – night soil, pit latrines, septic tanks; Small scale sewage works – oxidation dams, biological filters and reed beds; Anaerobic digestion; Suspended – and Attached growth processes; Sludge handling and treatment. The module includes training and practice for simulation software for wastewater treatment processes. Focus on design aspects.

**WBW 787 Biological water treatment 787**
- **Academic organisation:** Chemical Engineering
- **Contact time:** 32 contact hours per semester
- **Period of presentation:** Semester 1
- **Language of tuition:** English
- **Credits:** 32
- **Module content:** Composition and characterisation of sewage; Basic design principles of: Simple sewage treatment systems – night soil, pit latrines, septic tanks; Small scale sewage works – oxidation dams, biological filters and reed beds; Anaerobic digestion; Suspended – and Attached growth processes; Sludge handling and treatment. The module includes training and practice for simulation software for wastewater treatment processes.

**WCW 780 Chemical water treatment 780**
- **Academic organisation:** Chemical Engineering
- **Contact time:** 32 contact hours per semester
- **Period of presentation:** Semester 1
- **Language of tuition:** English
- **Credits:** 32
- **Module content:** Water quality standards: drinking water quality standards (chemical), performance evaluation for drinking water treatment systems Basic water chemistry: Acid-base and solubility equilibrium chemistry; Chemistry of the carbonate system Conventional drinking water treatment: coagulation-flocculation; sedimentation, flotation; sand filtration; chlorination; chemical stabilisation. Advanced drinking water treatment: activated carbon adsorption; ozone and ultra-violet disinfection; enhanced coagulation; membrane processes; softening; iron and manganese removal. Industrial water treatment: chemical precipitation; neutralisation; oxidation-reduction; desalination processes; ion exchange.
Focus on design aspects.

**WCW 787 Chemical water treatment 787**

**Academic organisation:** Chemical Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32

**Module content:**  
Water quality standards: drinking water quality standards (chemical), performance evaluation for drinking water treatment systems. Basic water chemistry: Acid-base and solubility equilibrium chemistry; Chemistry of the carbonate system. Conventional drinking water treatment: coagulation-flocculation; sedimentation, flotation; sand filtration; chlorination; chemical stabilisation. Advanced drinking water treatment: activated carbon adsorption; ozone and ultra-violet disinfection; enhanced coagulation; membrane processes; softening; iron and manganese removal. Industrial water treatment: chemical precipitation; neutralisation; oxidation-reduction; desalination processes; ion exchange.

**WQB 780 Water quality management and research 780**

**Academic organisation:** Chemical Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32

**Module content:**  
Water quality parameters: physical, chemical, biological, microbiological; Units of expression; Evaluation of parameters; Methods of analysis and practical laboratory analyses; Water quality interpretation, evaluation and assessment, water quality guidelines and requirements for domestic, industrial, agricultural, ecological, recreational requirements; Limnology and water quality in rivers and lakes; Surface water modelling; Ground water quality and assessment; Regulatory aspects including all relevant legislation; Integrated environmental management, integrated pollution control; Procedures to assess effluent discharge impacts; and Water quality management, policies and procedures, role of catchment management agencies, and catchment management plans.

**WQB 787 Water quality management and research 787**

**Academic organisation:** Chemical Engineering  
**Contact time:** 32 contact hours per semester  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 32

**Module content:**  
Water quality parameters: physical, chemical, biological, microbiological; Units of expression; Evaluation of parameters; Methods of analysis and practical laboratory analyses; Water quality interpretation, evaluation and assessment, water quality guidelines and requirements for domestic, industrial, agricultural, ecological, recreational requirements; Limnology and water quality in rivers and lakes; Surface water modelling; Ground water quality and assessment; Regulatory aspects including all relevant legislation; Integrated environmental management, integrated pollution control; Procedures to assess effluent discharge impacts; and Water quality management, policies and procedures, role of catchment management agencies, and catchment management plans.

**WWP 121 Workshop practice 121**

**Academic organisation:** Mechanical and Aeronautical Engineering  
**Contact time:** 1 opw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng Credits: 6
Module content: *Attendance module only
The module is offered at the end of the first year of study and lasts at least eight days, during which training is given in the following workshops: electronic projects, panel wiring, electrical motors and switch gear, general machines, welding, turning and sheet metal work. Each student's progress is assessed after each workshop.

XUW 710 Postgraduate course: Other universities 710
Academic organisation: Electrical, Electronic and Computer Engineering
Period of presentation: Semester 1
Language of tuition: English Credits: 32

XUW 720 Postgraduate course: Other universities 720
Academic organisation: Electrical, Electronic and Computer Engineering
Period of presentation: Semester 2
Language of tuition: English Credits: 32

List of modules presented by other faculties

Faculty of Humanities

HAS 110 Humanities and social sciences 110
Academic organisation: Anthropology and Archaeology
Contact time: 2 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng Credits: 8
Module content:
Social sciences: Perspectives on contemporary society
An introduction to long-standing questions about the nature of human societies and contemporary challenges. Topics to be discussed include globalisation and increasing connectedness; rising unemployment, inequality and poverty; rapid urbanisation and the modern city form; transformations in the nature of work; environmental degradation and tensions between sustainability and growth; shifts in global power relations; the future of the nation-state and supra-national governance structures; and possibilities for extending human rights and democracy. Critical questions are posed about modern selfhood, sociality, culture and identity against the background of new communications technologies, ever more multicultural societies, enduring gender, class and race inequities, and the emergence of new and the resurgence of older forms of social and political identity. These issues are approached from the vantage of our location in southern Africa and the continent, drawing on social science perspectives.

HAS 120 Humanities and social sciences 120
Academic organisation: Afrikaans
Contact time: 2 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng Credits: 8
Module content:
Humanities: Text, culture and communication
Successful communication of ideas, values and traditions depends on understanding both the literal and implied meanings of texts. In this module students are introduced to
a variety of texts, including original literary and visual texts, with a view to developing an understanding of how textual meanings have been constructed and negotiated over time. Students are encouraged to understand themselves as products of – and participants in – these traditions, ideas and values. Appropriate examples will be drawn from, among others, the Enlightenment, Modernism, Existentialism, Postmodernism and Post-colonialism.

### Faculty of Natural and Agricultural Sciences

**CHM 171 General chemistry 171**  
**Academic organisation:** Chemistry  
**Contact time:** 1 dpw 4 lpw 1 ppw 1 wbppw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  
General introduction to inorganic, analytical and physical chemistry. Nomenclature of inorganic ions and compounds, stoichiometric calculations concerning chemical reactions, redox reactions, solubilities and solutions, atomic structure, periodicity. Molecular structure and chemical bonding using the VSEPR model. Principles of reactivity, electrochemistry, energy and chemical reactions, entropy and free energy. Appropriate tutorial classes and practicals.

**CHM 172 General chemistry 172**  
**Academic organisation:** Chemistry  
**Contact time:** 1 dpw 4 lpw 1 ppw 1 wbppw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  
General introduction to inorganic, analytical and physical chemistry. Nomenclature of inorganic ions and compounds, stoichiometric calculations concerning chemical reactions, redox reactions, solubilities and solutions, atomic structure, periodicity. Molecular structure and chemical bonding using the VSEPR model. Principles of reactivity, electrochemistry, energy and chemical reactions, entropy and free energy. Appropriate tutorial classes and practicals.

**CHM 181 General chemistry 181**  
**Academic organisation:** Chemistry  
**Contact time:** 1 dpw 4 lpw 1 ppw 1 wbppw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  
**Module content:**  
General physical-analytical chemistry: Physical behaviour of gases, liquids and solids, intermolecular forces, solutions, chemical equilibrium, acids and bases, buffers, precipitation. Organic chemistry: Structure (bonding) and functional groups, nomenclature, isomerism, introductory stereo-chemistry, introduction to chemical reactions and chemical properties of organic compounds. Appropriate tutorial classes and practicals.

**CHM 215 Chemistry 215**  
**Academic organisation:** Chemistry  
**Contact time:** 3 lpw 1 ppw  
**Language of tuition:** Double Medium  
**Credits:** 12
Module content:
Organic chemistry. Chemical properties of organic (including aromatic) compounds. Functional group transformation and synthesis.

CHM 226 Chemistry 226
Academic organisation: Chemistry
Prerequisite: CHM 171 or CHM 172 and CHM 181
Contact time: 2 lpw 6 ppw
Period of presentation: Semester 2
Language of tuition: Double Medium
Credits: 8

Module content:
Theory: Introduction to instrumental chemical analysis. Integration of electronic, chemical, optical and computer principles for the construction of analytical instrumentation. Detail discussion of principles and some instrumental methods from three disciplines within analytical chemistry, namely electrochemistry, spectroscopy and chromatography. This includes potentiometry, (AA) atomic absorption-, (ICP) atomic emission-, ultraviolet (UV)-, and infrared (IR) spectroscopy, potentiometric and photometric titrations, gas chromatography, liquid chromatography as well as combinations of these techniques. Practical: IR spectroscopy, UV spectroscopy, AA spectroscopy, potentiometric titration, gas chromatography.

FSK 116 Physics 116
Academic organisation: Physics
Contact time: 1 dpw 4 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng
Credits: 16

Module content:

FSK 176 Physics 176
Academic organisation: Physics
Contact time: 1 dpw 4 lpw 1 ppw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng
Credits: 16

Module content:
wavelength and frequency, interference of waves, standing waves, the Doppler effect. Temperature, heat and the first law of thermodynamics.

GLY 151 Introductory geology 151
Academic organisation: Geology
Contact time: 4 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: Eng Credits: 16

Module content
Solar system: Earth structure and systems; plate tectonics; classification and contextual setting of rocks and minerals; rock cycle; classification of rocks; internal and external geological processes; landscape formation; influences of geological environment on mankind; geological time and Earth's history through time. Geological maps; geological profiles; identification and description minerals and rocks.

GLY 161 Historical geology 161
Academic organisation: Geology
Prerequisite: Refer to Regulation 1.2: At least 60% for Mathematics in the Grade 12 examination
Contact time: 4 lpw 1 ppw
Period of presentation: Quarter 4
Language of tuition: Eng Credits: 8

Module content:
Principles of stratigraphy and stratigraphic nomenclature; geological dating and international and South African time scales; Africa framework and tectonic elements of South Africa; introduction to depositional environments. Overview of the historical geology of South Africa, from the Archaean to the present: major stratigraphic units, intrusions and tectonicmetamorphic events - their rock types, fossil contents, genesis and economic commodities. Principles of palaeontology and short description of major fossil groups: fossil forms, ecology and geological meaning. Geological maps and profiles; rock samples.

GLY 254 Structural geology 254
Academic organisation: Geology
Prerequisite: GLY 151*, GLY161, WTW 114/WTW 158 and FSK 116/FSK 176
Contact time: 4 lpw 1 ppw
Period of presentation: Quarter 1
Language of tuition: Eng Credits: 12

Module content:
Integrated theoretical and practical course dealing with the principles of rock deformation and analysis of deformed rocks. Stress, strain and rheology, joints, experimental rock deformation, fault systems and Anderson’s theory of faulting. Folds and interference folding, tectonic fabrics, shear zones, progressive deformation. Stereographic projection and structural analysis.

GLY 352 Geodynamics ore formation 352
Academic organisation: Geology
Prerequisites: GLY 254
Contact time: 4 lpw 1 ppw
Period of presentation: Quarter 3
Language of tuition: Eng Credits: 18

Module content
Principles of ore-forming processes and geological environments of ore formation; ore classification schemes; geometry of ore bodies; systematic review of major metallic and non-metallic ore types with examples; ore samples and ore mineralogy; mapping techniques.

**GLY 365 Structural geology 365**  
**Academic organisation:** Geology  
**Prerequisite:** Three of the second-year modules: GLY 255, GLY 261, GLY 262, GLY 253; special exemption is given to 4th-year Mining Engineering students who have completed their required 1st-year Geology modules  
**Contact time:** 4 lpw 2 ppw  
**Period of presentation:** Quarter 1  
**Language of tuition:** English  
**Credits:** 18  
**Module content:**  
Integrated theoretical and practical course dealing with the principles of rock deformation and analysis of deformed rocks. Stress, strain and rheology, joints, experimental rock deformation, fault systems and Anderson's theory of faulting. Folds and interference folding, tectonic fabrics, shear zones, progressive deformation. Stereographic projection and structural analysis.

**IGL 703 Engineering geology 703**  
**Academic organization:** Geology  
**Contact time:** 20 contact hours  
**Period of presentation:** Year  
**Language of tuition:** English  
**Credits:** 16  
**Module content:**  
Introduction to geology, SA stratigraphy and engineering geology, introduction to rock engineering, engineering geology in urban and regional development, dams, slopes and tunnels.

**IGL 704 Engineering geology 704**  
**Academic organization:** Geology  
**Contact time:** 10 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16

**SUR 220 Surveying 220**  
**Academic organisation:** Geography, Geoinformatics and Meteorology  
**Prerequisite:** WTW 158 GS  
**Contact time:** 3 lpw 1 ppw  
**Period of presentation:** Semester 2  
**Language of tuition:** Double Medium  
**Credits:** 16  
**Module content:**  

**WTW 158 Calculus 158**  
**Academic organisation:** Mathematics and Applied Mathematics  
**Prerequisite:** Refer to Regulation 1.2: At least 50% for Mathematics in the Grade 12 examination
Contact time: 4 lpw 1 tpw  
Period of presentation: Semester 1  
Language of tuition: Both Afr and Eng  
Credits: 16  
Module content:  
*This module is designed for first-year engineering students. Students will not be credited for more than one of the following modules for their degree: WTW 158, WTW 114, WTW 134.  
Introduction to vector algebra. Functions, limits and continuity. Differential calculus of single variable functions, rate of change, graph sketching, applications. The mean value theorem, the rule of L'Hospital. Indefinite integrals, integration.

WTW 164 Mathematics 164  
Academic organisation: Mathematics and Applied Mathematics  
Prerequisite: WTW 158 GS  
Contact time: 4 lpw 1 tpw  
Period of presentation: Semester 2  
Language of tuition: Both Afr and Eng  
Credits: 16  
Module content:  
*This module is designed for first-year engineering students. Students will not be credited for more than one of the following modules for their degree: WTW 146, WTW 148 and WTW 124. Vector algebra with applications to lines and planes in space, matrix algebra, systems of linear equations, determinants, complex numbers, factorisation of polynomials and conic sections. Integration techniques, improper integrals. The definite integral, fundamental theorem of Calculus. Applications of integration. Elementary power series and Taylor's theorem. Vector functions, space curves and arc lengths. Quadratic surfaces and multivariable functions.

WTW 238 Mathematics 238  
Academic organisation: Mathematics and Applied Mathematics  
Prerequisite: WTW 256 and WTW 258 GS  
Contact time: 4 lpw 2 tpw  
Period of presentation: Semester 2  
Language of tuition: Both Afr and Eng  
Credits: 16  
Module content:  
Linear algebra, eigenvalues and eigenvectors with applications to first and second order systems of differential equations. Sequences and series, convergence tests. Power series with applications to ordinary differential equations with variable coefficients. Fourier series with applications to partial differential equations such as potential, heat and wave equations.

WTW 256 Differential equations 256  
Academic organisation: Mathematics and Applied Mathematics  
Prerequisite: WTW 158, WTW 164/WTW 161, 168  
Contact time: 1 dpw 2 lpw  
Period of presentation: Semester 1  
Language of tuition: Both Afr and Eng  
Credits: 8  
Module content:  
WTW 258 Calculus 258  
**Academic organisation:** Mathematics and Applied Mathematics  
**Prerequisite:** WTW 158, WTW 164/ WTW 161, 168  
**Contact time:** 1 dpw 2 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 8  

**Module content:**  

WTW 263 Numerical Methods 263  
**Academic organisation:** Mathematics and Applied Mathematics  
**Prerequisite:** WTW 164/ WTW 161, 168  
**Contact time:** 1 dpw 2 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 8  

**Module content:**  

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**Faculty of Law**

BER 310 Business law 310  
**Academic organisation:** Mercantile Law  
**Contact time:** 4 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng  
**Credits:** 16  

**Module content:**  

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**Faculty of Economic and Management Sciences**

ABV 320 Labour relations 320  
**Academic organisation:** Human Resource Management  
**Contact time:** 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng  
**Credits:** 8  

**Module content:**  
The theoretical basis of Labour Relations  
In this section the basic concepts, historical context and theoretical approaches to the field of labour relations will be discussed. The institutional framework in which labour relations operates, will be addressed with particular emphasis on the structural mechanisms and institutional processes. The service relationship that forms the basis of labour relations practices, will also be analysed.  
Labour Relations practice  
In this section students are taught the conceptual and practical skills related to practice
aspects such as handling of grievances, disciplining, retrenchments, collective bargaining, industrial action and dispute resolution.

BSR 410 Management Accounting 410
Academic organisation: Financial Management
Prerequisite: FBS 110
Contact time: 6 lpw
Period of presentation: Semester 1
Language of tuition: English Credits: 16
Module content:

FBS 110 Financial management 110
Academic organisation: Financial Management
Contact time: 3 lpw
Period of presentation: Semester 1
Language of tuition: English Credits: 10
Module content:
*Only for BSc (Mathematical Statistics, Construction Management, Real Estate and Quantity Surveying) and BEng (Industrial Engineering) students.

FBS 830 Financial management 830
Academic organisation: Financial Management
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English Credits: 10

FBS 831 Financial management 831
Academic organisation: Financial Management
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English Credits: 16

PEM 883 People management 883
Academic organisation: Human Resource Management
Contact time: 3 dpw 16 lpw 2 wbppw
Period of presentation: Semester 2
Language of tuition: English Credits: 10
PEM 884 People management 884  
**Academic organisation:** Human Resource Management  
**Contact time:** 3 dpw 16 lpw 2 wbppw  
**Period of presentation:** Semester 1  
**Language of tuition:** English

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COS 110 Program design: Introduction 110  
**Academic organisation:** Computer Science  
**Prerequisite:** COS 132, COS 151 and Maths level 5  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng

**Module content:**  
The focus is on object-oriented (OO) programming. Concepts including inheritance and multiple inheritance, polymorphism, operator overloading, memory management (static and dynamic binding), interfaces, encapsulation, reuse, etc. will be covered in the module. The module teaches sound program design with the emphasis on modular code, leading to well structured, robust and documented programs. A modern OO programming language is used as the vehicle to develop these skills. The module will introduce the student to basic data structures, lists, stacks and queues.

COS 122 Operating systems 122  
**Academic organisation:** Computer Science  
**Prerequisite:** COS 132  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 2  
**Language of tuition:** Both Afr and Eng

**Module content:**  
Fundamental concepts of modern operating systems in terms of their structure and the mechanisms they use are studied in this module. After completing this module, students will have gained, as outcomes, knowledge of real time, multimedia and multiple processor systems, as these will be defined and analysed. In addition, students will have gained knowledge on modern design issues of process management, deadlock and concurrency control, memory management, input/output management, file systems and operating system security. In order to experience a hands-on approach to the knowledge students would have gained from studying the abovementioned concepts, students will have produced a number of practical implementations of these concepts using the Windows and Linux operating Systems.

COS 132 Imperative programming 132  
**Academic organisation:** Computer Science  
**Prerequisite:** APS of 30 and level 5 (60-69%) Mathematics  
**Contact time:** 1 ppw 1 tpw 3 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** Both Afr and Eng

**Module content:**  
This module introduces imperative computer programming, which is a fundamental building block of computer science. The process of constructing a program for solving a...
given problem, of editing it, compiling (both manually and automatically), running and debugging it, is covered from the beginning. The aim is to master the elements of a programming language and be able to put them together in order to construct programs using types, control structures, arrays, functions and libraries. An introduction to object orientation will be given. After completing this module, the student should understand the fundamental elements of a program, the importance of good program design and user-friendly interfaces. Students should be able to conduct basic program analysis and write complete elementary programs.

**COS 212 Data structures and algorithms 212**

**Academic organisation:** Computer Science  
**Prerequisite:** COS 110  
**Contact time:** 1 ppw 4 lpw  
**Period of presentation:** Semester 1  
**Language of tuition:** English  
**Credits:** 16

**Module content:**
Data abstraction is a fundamental concept in the design and implementation of correct and efficient software. In prior modules, students are introduced to the basic data structures of lists, stacks and queues. This module continues with advanced data structures such as trees, hash tables, heaps and graphs, and goes into depth with the algorithms needed to manipulate them efficiently. Classical algorithms for sorting, searching, traversing, packing and game playing are included, with an emphasis on comparative implementations and efficiency. At the end of this module, students will be able to identify and recognise all the classical data structures; implement them in different ways; know how to measure the efficiency of implementations and algorithms; and have further developed their programming skills, especially with recursion and polymorphism.