FACULTIES OF THE
UNIVERSITY OF PRETORIA

HUMANITIES
NATURAL AND AGRICULTURAL SCIENCES
LAW
THEOLOGY
ECONOMIC AND MANAGEMENT SCIENCES
VETERINARY SCIENCE
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HEALTH SCIENCES
ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

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ISBN 978-1-86854-718-0

FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

PART I
(this publication)

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

GRADUATE SCHOOL OF TECHNOLOGY MANAGEMENT
- Engineering and Technology Management

PART II
(separate publication)

SCHOOL FOR THE BUILT ENVIRONMENT
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Jones, E ..... Head: Student Administration

GENERAL INFORMATION

The information regarding degree programmes here published is subject to change and may be amended prior to the commencement of the academic year in 2009.

Admission
Any person who wishes to register at the University for the first time, or after an interruption of studies, should apply or reapply for admission. Application for admission to all programmes closes on 30 September.

Selection
A selection procedure takes place prior to admission to any programme in the School of Engineering. Restrictions may be placed on the number of students admitted to the School and/or its departments. Postgraduate selection takes place as stipulated in the respective departmental rules.

Statement of symbols
When registering at this University for the first time, an undergraduate candidate must submit a statement of symbols obtained for subjects in the Grade 12 examination.

National Senior Certificate
All undergraduate candidates who enroll at the University of Pretoria for the first time, must show their original National Senior Certificate at the Student Administration of their faculty before the end of the first semester.

Medium of instruction
In conducting its business, the University uses two official languages, namely Afrikaans and English.

In formal education, the medium of instruction is either Afrikaans or English, or both of these languages, provided that there is a demand and that it is academically and economically justifiable. However, it remains the student's responsibility to ascertain on an annual basis in which language a module and any further level of that module is presented.

In respect of administrative and other services, a student has the right to choose whether the University should communicate with him or her in Afrikaans or English.

Bursaries and loans
Particulars about bursaries and loans are available on request.

Accommodation
Applications for accommodation in university residences for a particular year may be submitted as from 1 March of the preceding year. Applications will be considered while vacancies exist, and prospective students are advised to apply well in advance. Please note that admission to the University does not automatically mean that lodging will also be available.

Welcoming day and academic orientation week
Details of the welcoming day to which all parents are cordially invited, and the subsequent orientation week during which all new first-year students **must** be present, are obtainable from the Dean of Students, University of Pretoria, Pretoria 0002.

Prescribed books
Lists of prescribed books are not available. The lecturers will supply information regarding prescribed books to students at the commencement of lectures.

Amendment of regulations and fees
The University retains the right to amend the regulations and to change tuition fees without prior notification.
NB The fees advertised and thus levied in respect of a module or study programme presentation represents a combination of the costs associated with the formal services rendered (for example lectures, practicals, access to laboratories, consumables used in laboratories, etc.) as well as associated overheads such as the provision of library and recreation facilities, security and cleaning services, electricity and water supply, etc. Therefore the fees in respect of a module or study programme presentation cannot simply be reconciled with the visible services that are rendered in respect of such module or study programme.

SYSTEM OF TUITION

In 2001, the School of Engineering commenced with phasing in a new system of tuition, which corresponds with the required guidelines of SAQA (the South African Qualifications Authority) and the NQF (National Qualifications Framework), as well as with the accreditation requirements of ECSA (Engineering Council of South Africa). In this system, programmes are offered which are outcomes-based, student-centred and market-orientated. More information on this matter is given in the Glossary of Terms below, as well as in Regulation Eng. 13.

GLOSSARY OF TERMS

academic year: The duration of the academic year which is determined by the University Council.
admission regulation: A regulation compiled by the dean concerning the admission of students to a specific School, which includes a provision regarding the selection process.
credit (or **credit value**): A value unit linked to learning activities, calculated in accordance with the SAQA norm of 1 **credit = 10 notional hours (learning hours)**. Credits are linked to modules and qualifications. In the School of Engineering modules normally carry credit values of 8 or 16 each, and typically a total of 640 credits is required for the Bachelor of Engineering degree.
curriculum: A series of modules which form a programme, grouped together over a specified period of time and in a certain sequence according to the regulations.
ECSA: Engineering Council of South Africa. This is a statutory council which is inter alia responsible for the registration of professional engineers and for the accreditation of the academic programmes for engineers at South African universities.
examination mark: The mark a student obtains for an examination in a module, including practical examinations where applicable.
extended study programme: A study programme for a degree or diploma that is completed over a longer period than the minimum duration of the particular degree or diploma.
final mark: The mark calculated on the basis of the semester/year mark and the examination mark a student obtains in a particular module according to a formula which is determined from time to time in the regulations for each module with the proviso that

should no semester/year mark be required in a module, the examination mark serves as the final mark.
GS: A combined (final) mark (semester/year mark and examination mark) of 40% - 49%.
learning outcome: The end product of a specified learning process, i.e. the learning result (specific skills) that one intends to achieve at the end of the learning process.
level of a module: The academic level (year) of a module which is indicated in the module code, which gives an indication of the complexity of the module.
module: An independent, defined learning unit, designed to result in a specific set of learning outcomes, and which is a component of a programme.
module code: Consists of an equal number of letters and digits, which indicate the name of the module, the year of study, the period of study and the level of the module.
notional hours (learning hours): The estimated number of hours students should spend to master the learning content of a particular module or programme. The total number of learning hours for a module consists of the time needed for lectures, tutorials and practicals (contact hours), as well as for self-study, examination preparation and any other activity required by the study programme. (**notional hours = credits x10**)
NQF: National Qualifications Framework. This is a national framework in which all SAQA-registered qualifications are listed, arranged on eight levels in accordance with the complexity of the qualification.
programme: This is a comprehensively planned, structured and coherent set of teaching and learning units (modules), designed to satisfy a specific set of outcomes at exit-level, which culminates in a student being awarded a particular qualification (diploma, degree).
promotion: Promotion means that for certain modules a student may be exempted from the final examination, provided that a student's semester or year mark for the module exceeds a certain predetermined minimum percentage (e.g. 75%).
qualification: In outcomes-based education, a qualification is a diploma or a degree which is obtained after attaining the learning outcomes as specified in a coherent learning programme, expressed as an accumulation of credits at specific levels.
SAQA: South African Qualifications Authority. This body has been established by law and has as its purpose the registration of qualifications, programmes and unit standards, in order to ensure that specific national and international criteria are achieved.
semester/year mark: The mark a student obtains during the course of a semester or a year for tests, class-work, practical work or any other work in a particular module as approved by regulation.
student-centred learning: Teaching and learning methodology which facilitates the student's own responsibility for the learning process. A prerequisite is that lectures, tutorials and practicals be adapted so that active participation by students is always achieved.
syllabus: Summary of the contents of a module.
weighted average: The weighted average is composed of the marks of the various modules, weighted with the credits of each module as a fraction of the total number of credits for the semester or year.

DEGREES CONFERRED IN THE SCHOOL OF ENGINEERING AND GRADUATE SCHOOL OF TECHNOLOGY MANAGEMENT

The following degree is awarded in the School of Engineering (minimum duration in brackets):

(a) **Bachelor's degree:**
  (i) Bachelor of Engineering – BEng (four years)

The following degrees are awarded in the School of Engineering and the Graduate School of Technology Management (minimum duration in brackets):

(a) **Honours degrees:** (one year)
  (i) Bachelor of Engineering (Honours) – BEng(Hons)
  (ii) Bachelor of Science (Honours) – BSc(Hons)
(b) **Master's degrees:** (one year)
  (i) Master of Engineering – MEng
  (ii) Master of Science – MSc
(c) **Doctorates:** (one year)
  (i) Doctor of Philosophy– PhD
  (ii) Doctor of Philosophy in Engineering – PhD(Eng)
  (iii) Doctor of Engineering – DEng

REGULATIONS FOR THE BACHELOR'S DEGREE OF ENGINEERING (BEng)

Eng. 1
Admission to degree study
General Regulations G.1 to G.15 are applicable to all bachelor's degrees. Where the General Regulations have vested authority in the Faculty to determine its own provisions, these provisions appear in this publication.

General
To register for a first bachelor's degree at the University, a candidate must, in addition to the required National Senior Certificate with admission for degree purposes, comply with the specific admission requirements for particular programmes and fields of study as prescribed in the admission regulations and the regulations of the departments. Applicants are notified in writing of provisional admission. Admission to the School of Engineering is based on the final matriculation examination results.

(a) The following persons may also be considered for admission:
  (i) A candidate who is in possession of a certificate which is deemed by the University to be equivalent to the required National Senior Certificate with admission for degree purposes.
  (ii) A candidate who is a graduate from another tertiary institution or has been granted the status of a graduate of such an institution.
  (iii) A candidate who passes an entrance examination, which is prescribed by the University from time to time.

  Abovementioned candidates are requested to contact the faculty for more information regarding admission requirements.

  Note: A conditional exemption certificate does not grant admission to bachelor's study. However, in certain circumstances some of the faculties do accept a

conditional exemption on the basis of mature age and prior knowledge. Candidates are advised to contact the specific faculty administration in this regard.

(b) The Senate may limit the number of students allowed to register for a programme, in which case the Dean concerned may, at his discretion, select from the students who qualify for admission those who may be admitted.

(c) Subject to faculty regulations and the stipulations of General Regulations G.1.3 and G.62, a candidate will only be admitted to postgraduate studies, if he or she is already in possession of a recognised bachelor's degree.

Academic literacy

It is expected of all new undergraduate students who wish to study at the University to sit for an academic literacy test. Certain modules which address shortcomins in this respect, are included in the undergraduate curriculum, as indicated in Eng. 15.1 and 15.2. In addition, modules which have the purpose of developing specific language and communication skills in the context of the requirements of the engineering profession are also included in the curriculum.

Computer and information literacy

The first-year engineering programme includes Information Technology modules comprising basic computer and information literacy which are compulsory for all students. Students who are of the opinion that they already have these skills, may take an exemption test.

Admission requirements for candidates with a National Senior Certificate (NSC) from 2009

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.

Rating code	Rating	Marks %
7	Outstanding achievement	80-100%
6	Meritorious achievement	70-79%
5	Substantial achievement	60-69%
4	Adequate achievement	50-59%
3	Moderate achievement	40-49%
2	Elementary achievement	30-39%
1	Not achieved	0-29%

Preliminary admission is based on the results obtained in the final Grade 11 examination. Final admission is based on Grade 12 results. Please note: The final Grade 12 results will be the determining factor with regard to admission.

Alternative admission channels:

Candidates with an APS lower than required could be considered for admission to the

faculty if they meet the additional assessment criteria specified by the faculty from time to time. Preference will, however, be given to students who comply with the regular admission requirements of the faculty.

Specific requirements for the Faculty of Engineering, Built Environment and Information Technology from 2009

1. A valid National Senior Certificate with admission for degree purposes.
2. Minimum subject and level requirements

School of Engineering – minimum requirements						
Degree	**APS**	**Group A**			**Group B**	
		Two Languages	**Mathematics**	**Life Orientation**	**Physical Science**	**2 Other subjects**
Engineering (4-year programme)	30	Comply with NSC minimum require-ments; ADDITIONALLY one of these languages must be Afrikaans OR English at level 5 (60-69%).	6 (70-79%)	4 (50-59%) (Excluded when calculating the APS)	5 (60-69%)	Any two subjects
Engineering (5-year programme) Compulsory Admissions Test	24	Comply with NSC minimum requirements; ADDITIONALLY one of these languages must be Afrikaans OR English at level 4 (50-59%).	5 (60-69%)	4 (50-59%) (Excluded when calculating the APS)	4 (50-59%)	Any two subjects

Eng. 2

(a) **Registration for a specific year**

A student registers for all the modules he or she intends taking in that specific year (first and second-semester modules and year modules) at the beginning of an academic year. Changes to a curriculum at the beginning of the second semester may be made only with the approval of the Dean.

(b) **Module credits for unregistered students**

There are students who attend lectures, write tests and examinations and in this manner earn “marks”, but have neither registered for modules nor registered as students. These marks will not be communicated to any student before he/she has provided proof of enrolment. A student cannot obtain any credits in a specific academic year for a module “passed” in this manner during a previous academic year and for which he/she was not registered. This arrangement applies even where the student is prepared to pay the tuition fees.

Eng. 3

Examinations

(a) **Examinations, projects and essays**

(i) An examination in a module may be written and/or oral. Projects and essays

are prepared and examined as stipulated in the study guide of the module, in accordance with the regulations and procedures as described in (c) below.

(ii) The examinations for modules of the first semester are held in May/June, while all other examinations (second-semester modules and year modules) are held in October/November.

(b) **Examination admission**

A student must obtain a minimum semester/year mark of at least 40% to gain examination admission to a module, with the exception of first-year modules at first-semester level where at least 30% is required. In addition, all other examination requirements as applicable to the specific module, must be satisfied.

(c) **Pass requirements**

Refer also to General Regulations G.11.1(a) and G.12.2.2

(i) In order to pass a module a student must obtain an examination mark of at least 40% and a final mark of at least 50%. A student passes a module with distinction if a final mark of at least 75% is obtained. The final mark is compiled from the semester/year mark and the examination mark. Border cases (e.g. a mark of 49% or 74%) must be reconsidered by both the internal and external examiners, for determination of the possible merit of an upward adjustment of the mark. Marks may not be adjusted downwards, except when obvious marking and adding errors were detected. The pass mark is a minimum final mark of 50% and a student fails the module if a lower mark (e.g. 49%) was obtained.

(ii) Calculation of the final mark: The semester/year mark must account for no less than 40% and no more than 60% of the final mark, with the exception of modules like design and research projects and essays, as well as in modules where the development of general skills is the primary learning activity, where appropriate alternative norms are determined by individual schools or departments. The specific details and/or formula for the calculation of the final mark are given in the study guide of each module. Also, a schedule listing this information for all the modules presented in each school will be compiled, for approval by the Dean.

(iii) Calculation of the semester/year mark. The semester/year mark is compiled from formative assessment of learning activities such as assignments, presentations, practicals and group projects, as well as from class tests and semester tests. For each module the specific formula for the calculation of the semester/year mark is determined by the lecturer(s) responsible for the presentation of the module and the details are given in the study guide of the module. Also, a schedule listing this information for all the modules presented in each school will be compiled, for approval by the Dean. Refer also to General Regulation G.11.1(b).

(iv) In some modules specific requirements in respect of certain components of the semester/year mark may be set, in order for a student to pass the module (for example that satisfactory performance in and attendance of practical classes are required). Thus, even if a pass mark is obtained in the module, a pass is not granted unless these requirements are met. For such modules these specific requirements are given in the study guide of the module. Also, a schedule listing this information for all such modules presented in each school will be compiled, for approval by the Dean.

(v) A student must comply with the subminimum requirements in subdivisions of certain modules. For such modules these specific requirements are

given in the study guide of the module. Also, a schedule listing this information for all such modules presented in each school will be compiled, for approval by the Dean.

(vi) General Regulation G.10.3 is normally not applied by the School of Engineering and no promotion (exemption from the examination) is allowed in any module, except in special cases where permission of the Dean is required.

(d) **Ancillary examinations**
Refer to General Regulation G.12.3

(e) **Supplementary examinations**
Refer to General Regulation G.12.3
In the School of Engineering a supplementary examination is only granted in instances where:

(i) A final mark of between 45% and 49% was achieved;
(ii) A final mark of between 40% and 44% was achieved and where the candidate also achieved either a semester mark or an examination mark of 50% or higher;
(iii) A pass mark has been obtained, but the required subminimum in the examination section of the module or divisions thereof has not been obtained.
(iv) First-year modules on 100 level where a final mark of between 40% and 49% has been obtained, must be granted a supplementary examination.

Calculation of the final supplementary examination mark:

(1) The semester mark is retained and the final mark is calculated as the weighted average of the supplementary examination mark and the semester mark, in accordance with the formula as published in the study manual of the specific module, with the proviso that the maximum final mark awarded may be no more than 50%. The only exception to this rule is in the case of first-year modules on first-semester level, where the semester mark is not considered, and where the supplementary examination mark is taken as the final mark, with the proviso that the maximum final mark awarded may be no more than 50%.
(2) All other pass requirements, as published in the study manual of each specific module, remain so and are applicable during the determination of the final result of a supplementary examination in the module.

Special supplementary examinations will not be arranged for students who were not able to write the supplementary examinations during scheduled times, as given in the examinations timetable.

(f) **Special examinations (including the aegrotat)**
Refer to General Regulation G.12.5

(g) **Other special examinations**
Refer also to General Regulation G.12.6

(i) The Dean may, at the recommendation of the Head of the Department concerned, grant a special examination in a module to a student who wrote the examination and failed that module in the final year of study, and consequently does not comply with degree requirements. A student may be granted at most two such special examinations. No other special examinations are granted in the School of Engineering.
(ii) A student should apply in writing to the Dean to be considered for such special examination(s). The Head of the Department decides when a special

examination will take place and may prescribe work to be completed satisfactorily before a student may sit for such an examination.

(iii) During calculation of the final mark the semester mark is retained and the final mark is calculated as the weighted average of the special examination mark and the semester mark, in accordance with the formula as published in the study manual of the specific module, with the proviso that the maximum final mark awarded may be no more than 50%.

(h) **Re-marking of examination scripts**
Refer to General Regulation G.14

(i) **Duration of examinations in undergraduate modules**
The duration of an examination in an 8-credit module will not exceed 90 minutes and in a 16-credit module will not exceed 180 minutes, except where special approval is granted by the Dean to exceed these limits.
The duration of a supplementary examination or a special examination in all undergraduate modules will not exceed 90 minutes, except where special approval is granted by the Dean to exceed this limit. In the event of an aegrotat, the duration of the examination can be extended to a maximum period of 180 minutes, depending on an arrangement made between the lecturer and the student.

Eng. 4
Renewal of registration
Should a student who is repeating a year of study, with the exception of first-year students, fail to obtain sufficient credits to be promoted to the subsequent year of study at the end of the year of repetition, he or she will forfeit his or her right to readmission. Students who forfeit the right to readmission, may apply in writing to the Admissions Committee for readmission to the Faculty. Provisions regarding promotion, including provisions for first-year students, appear in the regulations of the relevant fields of study.

Eng. 5
Five-year programme
(a) The five-year programme is followed by students whose school achievements have been influenced negatively by disadvantages in the school system, but who have the potential to benefit from an extended study programme with academic support.
(b) Placement on the five-year programme takes place in accordance with the admission regulation of the School of Engineering. Therefore, candidates who obtain a 5 for Mathematics and/or a 4 for Physical Science in the Grade 12 examination, or candidates having an APS lower than 30 but higher than 24, are required to write an admissions test. Admission to the extended study programme will then be decided by the Admissions Committee on grounds of the results of the test. Students who have previously studied at a tertiary institution will not be considered for the extended study programme.
(c) Attendance at tutor sessions for students on the extended study programme is compulsory. In addition, the modules Professional Orientation (JPO) 110 and 120 are presented for students with the biggest school handicap and address the development of mathematical, communication and technological skills.
(d) A new first-year student who is enrolled for the five-year programme, who passes only Professional Orientation and none of the other prescribed modules at the end of the first semester, will not be permitted to continue with his/her studies at the end of the first semester.

(e) The rules and regulations applicable to the four-year programme are *mutatis mutandis* applicable to the five-year programme except where otherwise indicated in the regulations of the five-year programme.

Eng. 6
Modules from other faculties
A student who follows a module presented by another school or faculty must familiarise himself or herself with the admission requirements of the specific module, the subminima in examination papers, time of supplementary examinations, etc.

Eng. 7
Change of field of study
Transfer from one field of study to another may only take place with the Dean's approval, after consultation with the relevant Head of Department.

Eng. 8
Minimum study period
The minimum period of study for the degree is four years of full-time study.

Eng. 9
First-aid Certificate
As from 2004 the First-aid Certificate is no longer a requirement for the BEng degree.

Eng. 10
Exposure to the practice of engineering
Engineering students are exposed in three ways to the practice of engineering during the course of their studies:
(a) Workshop Practice – a module comprising a period at the end of the first year of study during which students are trained in workshop practice. Students in electrical, electronic and computer engineering attend the measurement techniques and computer modelling module.
(b) Practical Training – specific periods of work at firms during which experience is gained in the practice of engineering. Students may deviate from this stipulation only with the permission of the Dean.
(c) Excursions – study excursions arranged for students to visit various engineering firms and installations in order to obtain insight into the industry. This training is compulsory. Details of the modules regarding these aspects of training are explained in the sections of this publication which deal with the curricula and syllabi of the various programmes.

Eng. 11
Registration of modules
(a) Final cut-off dates are set for the change of modules (removing or adding) for each academic year. These dates are available from the Student Administration offices.
(b) **A student may not register for a module of a subsequent year if a timetable clash occurs with a module of a previous year which has not yet been passed and which is prescribed for his or her field of study, unless exemption is obtained from class attendance in the module of the previous year.**
(c) Should a student register for modules of the second semester at the beginning of a year of study, and it becomes evident at the end of the first semester, that he or she does not comply with the prerequisites of the second-semester modules, the registration of such modules will be cancelled. It is also the student's responsibility

to ensure at the beginning of the second semester that the cancellation has been brought about.

Eng. 12

12.1 Degree classification

(a) **Pass with distinction:**

A student graduates with distinction if:

(i) no module of the third or fourth year of study 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.

(b) ***First-class pass**

A student obtains a first-class pass if no modules of the fourth year were repeated and a weighted average of at least 60% was obtained in all the modules of the fourth year.

(c) ***Second-class pass**

A student obtains a second-class pass if no modules of the fourth year were repeated.

(d) ***Third-class pass**

A student obtains a third-class pass if some modules of the fourth year of study had to be repeated.

(e) **Exceptions**

Exceptional cases to any of these classifications will be considered by the Dean.

* Instituted in order to comply with standards set by various international accreditation bodies. *Pass with Distinction* and *First-Class Pass* are indicated on the degree certificate. Degree classifications are also indicated on the candidate's academic record on request.

12.2 Dean's Merit List

The Dean's Merit List will be published annually on the website of the Faculty and will contain the names of the students whose academic performance over the year has been excellent and deserves recognition. Letters of commendation will be sent to students who qualify for inclusion on the Dean's Merit List.

To be eligible for inclusion in the Dean's Merit List, a student must pass all the modules as prescribed in the curriculum of a specific year of study as published in the Rules and Syllabi, Part I, University of Pretoria, 2009. A student registered for the first, second or third year of the four year programme must obtain a minimum weighted average of 75% and a student registered on the first, second, third or fourth year of the five year programme must obtain a minimum weighted average of 75%.

CURRICULA FOR THE BEng PROGRAMMES

Eng. 13
Fields of study, learning outcomes and learning contents (syllabi)

The Bachelor of Engineering degree may be obtained in the following fields of study:
(a) Chemical Engineering (12130021)
(b) Civil Engineering (12130081)
(c) Computer Engineering (12130101)
(d) Electrical Engineering (12130031)
(e) Electronic Engineering (12130091)
(f) Industrial Engineering (12130011)
(g) Mechanical Engineering (12130051)
(h) Metallurgical Engineering (12130061)
(i) Mining Engineering (12130071)

All aforementioned 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. All the undergraduate programmes were recently restructured and the new programme for the first year of study was phased in in 2008 and the second year will be phase in from 2009. The new 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:
(a) Engineering problem solving.
(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:
(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%).

Eng. 14
Module information
With a few exceptions, most modules offered at the Scool 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.

The curriculum of each programme is given in Regulations Eng. 15.1 and 15.2 in this publication, in which the information of **each module** is given, as per the following example:

Module		**Credits**	**Prerequisites**
XYZ 163	Mathematics 163	16	XYZ 151

(a) **XYZ 163 :** Module code
XYZ : A letter code of which the first letter identifies the department/ division which offers the relevant module(s), as indicated in the table below:

Letter	**Department**
	School of Engineering:
B	Industrial and Systems Engineering
C	Chemical Engineering
E	Electrical, Electronic and Computer Engineering
M	Mechanical and Aeronautical Engineering
N	Materials Science and Metallurgical Engineering
P	Mining Engineering
S	Civil Engineering
	Graduate School of Technology Management:
I	Engineering and Technology Management

163 : Numerical code of which the first digit indicates the level of the module (year of study during which the module is normally presented).

(b) **Mathematics 163 :** Name of the module, as well as three digits which are similar to the numeric part of the module code.
(c) **16 :** Number of credits allocated to the module. This is the value or the "weight" of the module, as estimated in accordance with the SAQA norm of **1 credit = 10 notional hours**. For example, for a module with a credit value of 16 the average student should devote approximately 160 hours (10 hours per week) in order to be able to achieve the set learning outcomes of the module (contact time, own study time and examination preparation time are all included). Lecturers are obliged to ensure that this is a fair time estimate when setting the workload of the module.

(d) **XYZ 151 :** Prerequisite. Before a student is admitted to a module (XYZ 163), he or she must pass the prerequisite module(s) (XYZ 151), unless one of the following indications is used:

		Minimum requirement
()	Code in brackets: (XYZ 151)	Examination admission
GS	Code followed by GS: XYZ 151 GS	Average of 40% - 49%
†	Code followed by †: XYZ 151†	Concurrent registration

Deviations from these requirements may be permitted only with the approval of the Dean, after consultation with the relevant Head(s) of Department(s).

Eng. 15
Curricula

Eng. 15.1 Four-year Programmes
Please note:
The requirements for promotion from the one year of study to the next are given in **Eng. 16, Eng. 17** and **Eng. 18.**

Faculty requirement

Module		**Credits**	**Prerequisites**
JCP 203	Community-based Project 203	8	

Notes
Students who register for the first year from 2005 will be required to successfully complete the above module 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.

(a) Chemical Engineering

First year of study
First semester

Module		**Credits**	**Prerequisites**
MGC 110	Graphical Communication 110	16	
WTW 158	Calculus 158	16	
FSK 116	Physics 116	16	
CHM 171	General Chemistry 171	16	
CIR 113	Chemical Engineering 113	8	
CIL 111	Computer Literacy 111	4	
SNV 111	Innovation 111	4	
	Total	80	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
EBN 122	Electricity and Electronics 122	16	
SWK 122	Mechanics 122	16	WTW 158
CHM 181	General Chemistry 181	16	CHM 171
CIR 123	Chemical Engineering 123	8	CHM 171, CIR113
CIL 121	Information Literacy 121	4	

SNV 121	Innovation 121	4	SNV 111
	Total	80	

Recess training

WWP 121	Workshop Practice 121	6

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Students who failed the Academic Literacy Test must register for the module **JNV 100 (Innovation 100)**, which must be taken instead of the modules SNV 111 and SNV 121 (Innovation 111 and 121).

Second year of study

First semester

Module		**Credits**	**Prerequisites**
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
CHM 215	Chemistry 215	16	CHM 171/172, 181
SWK 210	Strength of Materials 210	16	SWK 122, WTW 168†
CIR 211	Chemical Engineering 211	8	CIR 123, WTW 256†
MPR 212	Programming & Data Processing 212	16	CIL 111, 121
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	80	

Second semester

WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
CHM 226	Chemistry 226	8	CHM 171/172, 181
EIR 221	Electrical Engineering 221	16	EBN 111/122, WTW 161
CTD 223	Thermodynamics 223	16	(CIR 213), MPR 212
BES 220	Engineering Statistics 220	8	
	Total	80	

Third year of study

First semester

Module		**Credits**	**Prerequisites**
COP 311	Transfer Processes 311	16	CPS 311† or MSX 310†
CTD 311	Thermodynamics 311	16	(CTD 222)
CBI 310	Biochemical Engineering 310	8	
CPS 311	Piping Systems Design 311	8	(CTD 222)
WTW 338	Mathematics 338	16	WTW 258 and 256 WTW 228 GS; 263 GS
BES 210	Engineering Statistics 210	8	
CSQ 311	Communication 311	8	JSQ 226, CPY 311†
	Total	80	

Second semester

CPD 320	Process Dynamics 320	12	(CTD 222)
CKN 320	Kinetics 320	12	(CTD 222)
CHO 321	Heat Transfer 321	8	(COP 311)
CLB 321	Laboratory 321	16	(CPS 311), CSQ 311, CPD 320†, CKN 320†, CMO320†, CHO 321†
CMO 320	Mass Transfer 320	16	(CTD 311)
COM 420	Environmental Management 420	8	
IPB 320	Project Management 320	8	
	Total	80	

Recess training

CPY 311	Practical Training 311	16	JSQ 226, (CTD 222)

Fourth year of study
First semester

Module		**Credits**	**Prerequisites**
CIR 412	Chemical Engineering 412	16	(COP 311)
CPS 410	Process Synthesis 410	16	CLB 321
CPB 410	Process Control 410	16	(CPD 320)
CRO 410	Reactor Design 410	16	(CKN 320)
CSC 411	Research Project 411	16	CLB 321, CPB 410†, CRO 410†
	Total	80	

Second semester

CPJ 421	Design Project 421	32	(CPB 410), (CRO 410); CPR 420†
CPR 420	Practice 420	16	
CSC 421	Research Project 421	16	(CSC 411)
CSS 420	Specialisation 420	16	
	Total	80	

Recess training

CPY 411	Practical Training 411	16	CSQ 311; CPY 311

(b) Civil Engineering

First year of study
First semester

Module		**Credits**	**Prerequisites**
MGC 110	Graphical Communication 110	16	
WTW 158	Calculus 158	16	
NMC 113	Materials Science 113	16	
EBN 111	Electricity and Electronics 111	16	
CIL 111	Computer Literacy 111	4	
SNV 111	Innovation 111	4	
	Total	72	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
FSK 176	Physics 176	16	
SWK 122	Mechanics 122	16	WTW 158
CHM 172	General Chemistry 172	16	
CIL 121	Information Literacy 121	4	
SNV 121	Innovation 121	4	SNV 111
	Total	72	

Recess training

SWP 121	Workshop Practice 121	6

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Students who failed the Academic Literacy Test must register for the module **JNV 100 (Innovation 100)**, which must be taken instead of the modules SNV 111 and SNV 121 (Innovation 111 and 121).

Second year of study

First semester

Module		**Credits**	**Prerequisites**
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
SWK 210	Strength of Materials 210	16	SWK 122, WTW 168†
SGM 210	Geomaterials and Processes 210	16	
SUR 210	Surveying 210	16	
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	80	

Second semester

WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
BES 220	Engineering Statistics 220	8	
SIN 223	Structural Analysis 223	16	WTW 161,168, SWK 210
SGM 221	Pavement Materials and Design 221	16	SGM 210 GS
SBZ 221	Civil Engineering Measurement Techniques 221	8	
	Total	72	

Third year of study

First semester

Module		**Credits**	**Prerequisites**
MSD 210	Dynamics 210	16	SWK 122, FSK 116/176, WTW 256†
SHC 310	Hydraulics 310	16	(SHC 220)

SIB 310	Timber Design 310	8	(SIN 223)
SIN 311	Structural Analysis 311	8	(SIN 223)
SVC 310	Transportation Engineering 310	8	
SBZ 310	Civil Construction Economics 310	8	(SIN 213)
SGM 311	Soil Mechanics 311	16	
	Total	80	

Second semester

SHC 320	Hydraulics 320	8	(SHC 310)
SGM 323	Geotechnical Engineering 323	16	(SGM 311)
SIN 323	Steel Design 323	8	(SIN 311)
SIN 324	Reinforced Concrete Design 324	8	(SIN 311)
SVC 324	Highway Design 324	8	
SIB 320	Construction Management and Equipment 320	8	
SBM 321	Civil Building Materials 321	16	
IPB 320	Project Management 320	8	
	Total	80	

Fourth year of study
First semester

Module		**Credits**	**Prerequisites**
SHC 410	Hydraulics 410	16	SHC 310, 320
SSC 411	Research Project 411	32	Finalists only
SIN 411	Steel Design 411	8	SIN 323
SIN 413	Reinforced Concrete Design 413	8	SIN 324
SVC 411	Transportation Planning 411	8	(TRP 311)
BPE 451	Professional Ethics and Practice 451	8	
	Total	80	

Second semester

SEV 421	Environmental Geotechnology 421	16	
SBZ 420	Civil Engineering Construction Management 420	16	Finalists only
SDC 420	Design Concept 420	8	Finalists only
SDO 420	Detailed Design 420	24	Finalists only
SPV 420	Public Presentation 420	8	Finalists only
	Total	72	

Recess training

SPY 410	Practical Training 410	16

(c) Computer Engineering

First year of study
First semester

Module		**Credits**	**Prerequisites**
WST 111	Mathematical Statistics 111	16	
WTW 158	Calculus 158	16	
EBN 111	Electricity and Electronics 111	16	
COS 131	Introduction to Programming 131	16	

CIL 111	Computer Literacy 111	4	
SNV 111	Innovation 111	4	
	Total	72	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
FSK 176	Physics 176	16	
EOS 284	Computer Architecture 284	16	COS 131
COS 121	Software Modeling 121	16	COS 131GS
CIL 121	Information Literacy 121	4	
SNV 121	Innovation 121	4	SNV 111
	Total	72	

Recess training

EMR 100	Measurement Techniques and Computer Modelling 100	4	(CIL 111), (EBN 111)
EIW 121	Information Technology Practice 121	8	

Note

Students who failed the Academic Literacy Test must register for the module **JNV 100 (Innovation 100)**, which must be taken instead of the modules SNV 111 and SNV 121 (Innovation 111 and 121).

Second year of study

First semester

Module		**Credits**	**Prerequisites**
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
COS 212	Data Structures & Algorithms 212	16	COS 131
EIR 211	Electrical Engineering 211	16	EBN 111/122, WTW 161
COS 121	Software Modeling 121	16	COS 131GS
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	80	

Second semester

WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
ELI 220	Linear Systems 220	16	EIR 211
ERS 220	Digital Systems 220	16	
COS 222	Operating Systems 222	16	COS 131
	Total	72	

Recess training

EIW 221	Information Technology Practice 221	8

Third year of study
First semester

Module		Credits	Prerequisites
WTW 342	Stochastic Processes 342	16	WTW 258 and 256 WTW 228 GS
EMS 310	Modulation Systems 311	16	ELI 220
EMK 310	Microprocessors 310	16	ERS 220
ERN 310	Computer Networks 310	16	COS 222, COS 214/121
EAI 310	Intelligent Systems 310	16	WTW 258
	Total	80	

Second semester

EOV 321	Design and Manufacturing 321	16	EMK 310GS
ESF 320	Digital Communication Systems 320	16	EMS 310 GS
EPE 321	Software Engineering 321	16	ERN 310
EOK 320	Optical Communication Networks 320	16	
EBB 320	Control Systems 320	16	ELI 220
	Total	80	

Recess training

EIW 320	Information Technology Practice 320	8	EIW 221

Fourth year of study
First semester

Module		Credits	Prerequisites
EPR 402	Project 402	16	All prescribed 3rd year modules passed
BPE 451	Professional Ethics and Practice 451	8	
ESP 411	DSP: Programming and Application 411	16	ESC 320GS or ESF 320GS
EAS 410	Computer Engineering: Architecture and Systems 410	16	EMK 310 GS
EHN 410	e-Business and Network Security 410	16	ERN 310 GS
	Total	72	

Second semester

EPR 402	Project 402	48	All prescribed 3rd year modules passed
EES 421	Specialisation for Computer Engineers 421	16	
BIE 320	Engineering Economics 320	8	
COM 420	Environmental Management 420	8	
	Total	80	

Recess training

EPY 421	Practical Training 421	12	

(d) Electrical Engineering

First year of study
First semester

Module		Credits	Prerequisites
EBN 111	Electricity and Electronics 111	16	
NMC 113	Materials Science 113	16	
WTW 158	Calculus 158	16	
MGC 110	Graphical Communication 110	16	
CIL 111	Computer Literacy 111	4	
SNV 111	Innovation 111	4	
	Total	72	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
FSK 176	Physics 176	16	
SWK 122	Mechanics 122	16	WTW 158
CHM 172	General Chemistry 172	16	
CIL 121	Information Literacy 121	4	
SNV 121	Innovation 121	4	SNV 111
	Total	72	

Recess training

EMR 100	Measurement Techniques and Computer Modelling 100	4	(CIL 111), (EBN 111)

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Students who failed the Academic Literacy Test must register for the module **JNV 100 (Innovation 100)**, which must be taken instead of the modules SNV 111 and SNV 121 (Innovation 111 and 121).

Second year of study
First semester

Module		Credits	Prerequisites
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
MSD 210	Dynamics 210	16	SWK 122, FSK 116/176, WTW 256†
EIR 211	Electrical Engineering 211	16	EBN 111/122, WTW 161
COS 131	Introduction to Programming 131	16	
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	80	

Second semester

WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168

BES 220	Engineering Statistics 220	8	
ELI 220	Linear Systems 220	16	EIR 211
ERS 220	Digital Systems 220	16	
	Total	64	

Recess training

EPW 200	Practical Wiring 200	4	

Third year of study
First semester

Module		**Credits**	**Prerequisites**
WTW 338	Mathematics 338	16	WTW 258 and 256 WTW 228 GS; 263 GS
EMZ 310	Electromagnetism 310	16	WTW 258, 256
ENM 311	Digital Circuits and Microprocessors 311	16	
EKK 310	Power System Components 310	16	EBN 210 or EKS 220
ELX 311	Electrical Machines 311	16	EBN 210, ELI 220
	Total	80	

Second semester

MIR 322	Introduction to Mechanical Eng. 322	16	MSD 210
EKS 320	Analysis of Power Systems 320	16	EKK 310
EBB 320	Control Systems 320	16	ELI 220
EDF 320	Power Electronics 320	16	EBN 210
EOV 320	Design and Manufacturing 320	16	EMK 310GS
	Total	80	

Recess training

EAW 300	Advanced Wiring 300	4	EPW 200

Fourth year of study
First semester

Module		**Credits**	**Prerequisites**
EPR 400	Project 400	16	All prescribed 3rd year modules passed
BPE 451	Professional Ethics and Practice 451	8	
EEM 410	Energy Systems 410	8	EKK 310 GS
EHB 410	High Voltage Control and Protection 410	8	EKK 310 GS
EAD 410	Electrical Drives 410	16	ELX 311 GS, EDF 320 GS
EBT 410	Automation 410	16	EBB 320 GS
	Total	72	

Second semester

EPR 400	Project 400	48	All prescribed 3rd year modules passed
EES 422	Specialisation for Electrical Engineers 422	16	

BIE 320	Engineering Economics 320	8
COM 420	Environmental Management 420	8
	Total	80

Recess training

EPY 422	Practical Training 422	12

(e) Electronic Engineering

First year of study
First semester

Module		**Credits**	**Prerequisites**
MGC 110	Graphical Communication 110	16	
WTW 158	Calculus 158	16	
NMC 113	Materials Science 113	16	
EBN 111	Electricity and Electronics 111	16	
CIL 111	Computer Literacy 111	4	
SNV 111	Innovation 111	4	
	Total	72	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
FSK 176	Physics 176	16	
SWK 122	Mechanics 122	16	WTW 158
CHM 172	General Chemistry 172	16	
CIL 121	Information Literacy 121	4	
SNV 121	Innovation 121	4	SNV 111
	Total	72	

Recess training

EMR 100	Measurement Techniques and Computer Modelling 100	4	(CIL 111), (EBN 111)

Note

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Students who failed the Academic Literacy Test must register for the module **JNV 100 (Innovation 100)**, which must be taken instead of the modules SNV 111 and SNV 121 (Innovation 111 and 121).

Second year of study
First semester

Module		**Credits**	**Prerequisites**
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
MSD 210	Dynamics 210	16	SWK 122, FSK 116/176, WTW 256†
EIR 211	Electrical Engineering 211	16	EBN 111/122, WTW 161

COS 131	Introduction to Programming 131	16	
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	80	

Second semester

WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
BES 220	Engineering Statistics 220	8	
ELI 220	Linear Systems 220	16	EIR 211
ERS 220	Digital Systems 220	16	
	Total	64	

Third year of study
First semester

Module		**Credits**	**Prerequisites**
WTW 342	Stochastic Processes 342	16	WTW 258, 256, WTW 228 GS
EMZ 310	Electromagnetism 310	16	WTW 258, 256
ENE 310	Analogue Electronics 310	16	ELK 220, ESL 220 GS **or** ELI 220 GS
EMK 310	Microprocessors 310	16	ERS 220
EMS 310	Modulation Systems 310	16	ELI 220
	Total	80	

Second semester

EOK 320	Optical Communication Networks 320	16	
EMZ 320	Electromagnetism 320	16	EMZ 310
EBB 320	Control Systems 320	16	ELI 220
ESC 320	Stochastic Communication Systems 320	16	EMS 310 GS, WTW 342
EOV 320	Design and Manufacturing 320	16	EMK 310GS
	Total	80	

Fourth year of study
First semester

Module		**Credits**	**Prerequisites**
EPR 400	Project 400	16	All prescribed 3rd year modules passed
BPE 451	Professional Ethics and Practice 451	8	
ESP 411	DSP: Programming and Application 411	16	ESC 320GS or ESF 320GS
ENE 410	Advanced Electronics 410	16	ENE 310 GS
EBT 410	Automation 410	16	EBB 320 GS
	Total	72	

Second semester

EPR 400	Project 400	48	All prescribed 3rd year modules passed
EES 423	Specialisation for Electronic Engineers 423	16	
BIE 320	Engineering Economics 320	8	

COM 420	Environmental Management 420	8
	Total	80

Recess training

EPY 422	Practical Training 422	12

(f) Industrial Engineering

First year of study
First semester

Module		**Credits**	**Prerequisites**
MGC 110	Graphical Communication 110	16	
WTW 158	Calculus 158	16	
FSK 116	Physics 116	16	
CHM 171	General Chemistry 171	16	
CIL 111	Computer Literacy 111	4	
SNV 111	Innovation 111	4	
	Total	72	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
EBN 122	Electricity and Electronics 122	16	
SWK 122	Mechanics 122	16	WTW 158
NMC 123	Materials Science 123	16	
CIL 121	Information Literacy 121	4	
SNV 121	Innovation 121	4	SNV 111
	Total	72	

Recess training

WWP 121	Workshop Practice 121	6

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Students who failed the Academic Literacy Test must register for the module **JNV 100 (Innovation 100)**, which must be taken instead of the modules SNV 111 and SNV 121 (Innovation 111 and 121).

Second year of study
First semester

Module		**Credits**	**Prerequisites**
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
MSD 210	Dynamics 210	16	SWK 122, FSK 116/176, WTW 256†
MOW 217	Manufacturing & Design 217	16	MGC 110, SWK 122
MPR 212	Programming & Data Processing 212	16	CIL 111, 121
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	80	

Second semester

WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
BES 220	Engineering Statistics 220	8	
MTX 221	Thermodynamics 221	16	FSK 116/176
BPZ 220	Productivity 220	16	
	Total	64	

Third year of study
First semester

Module		**Credits**	**Prerequisites**
BER 310	Business Law 310	8	
BVS 310	Manufacturing Systems 310	16	(BVS 221)
BOB 310	Operational Management 310	16	
BOZ 311	Operations Research 311	16	(BAN 222)
BFB 310	Facilities Planning 310	8	
FBS 110	Financial Management 110	10	
BIE 310	Engineering Economics 310	8	
	Total	82	

Second semester

BLK 320	Industrial Logistics 320	16	(BOB 310)
BRV 320	Computer-aided Manufacturing 320	8	(BVS 310)
BID 320	Information Systems Design 320	16	
BOZ 321	Operations Research 321	16	(BOZ 311)
BUY 321	Simulation Modelling 321	16	(BAN 222)
	Total	72	

Recess training

BPY 310	Practical Training 310	16

Fourth year of study
First semester

Module		**Credits**	**Prerequisites**
BCC 410	Computer Control 410	16	(BRV 320)
BON 410	Operations Research 410	16	
BGC 410	Quality Assurance 410	16	
BSR 410	Management Accounting 410	16	(FBS 110)
BPJ 410	Project 410	8	Finalists only
BPE 451	Professional Ethics 451	8	
	Total	80	

Second semester

BPJ 420	Project 420	32	(BPJ 410)
BPZ 421	Business Engineering 421	16	Finalists only
ABV 320	Labour Relations 320	8	BER 310
*BEN 420	Elective 420	16	Finalists only
COM 420	Environmental Management 420	8	
	Total	80	

* An elective chosen from an approved shortlist.

Recess training

BPY 410	Practical Training 410	16

(g) Mechanical Engineering

First year of study
First semester

Module		Credits	Prerequisites
MGC 110	Graphical Communication 110	16	
WTW 158	Calculus 158	16	
FSK 116	Physics 116	16	
CHM 171	General Chemistry 171	16	
CIL 111	Computer Literacy 111	4	
SNV 111	Innovation 111	4	
	Total	72	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
EBN 122	Electricity and Electronics 122	16	
SWK 122	Mechanics 122	16	WTW 158
NMC 123	Materials Science 123	16	
CIL 121	Information Literacy 121	4	
SNV 121	Innovation 121	4	SNV 111
	Total	72	

Recess training

WWP 121	Workshop Practice 121	6

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained. All practicum sessions have to be attended (passed) satisfactory.

(ii) Students who failed the Academic Literacy Test must register for the module **JNV 100 (Innovation 100)**, which must be taken instead of the modules SNV 111 and SNV 121 (Innovation 111 and 121).

Second year of study
First semester

Module		Credits	Prerequisites
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
MSD 210	Dynamics 210	16	FSK 116/176, SWK 122, WTW 256†
MPR 212	Programming & Data Processing 212	16	CIL 111, 121
MOW 217	Manufacturing & Design 217	16	MGC 110, SWK 122
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	80	

Second semester

WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
BES 220	Engineering Statistics 220	8	
MOW 227	Machine Design 227	16	MOW 217
MTX 221	Thermodynamics 221	16	FSK 116/176
	Total	64	

Third year of study
First semester

Module		**Credits**	**Prerequisites**
WTW 338	Mathematics 338	16	WTW 258, 256 and WTW 228 GS, 263 GS
MOW 312	Machine Design 312	16	MOW 222, MSK 222, (SWK 210)
MSY 310	Structural Mechanics 310	16	SWK 210, WTW 263
MSX 310	Fluid Mechanics 310	16	WTW 258†, 256†
BES 210	Engineering Statistics 210	8	
BIE 310	Engineering Economics 310	8	
	Total	80	

Second semester

MOW 323	Machine Design 323	16	(MOW 312)
MVR 320	Vibrations and Noise 320	16	(MSD 210)
MTX 321	Thermodynamics 321	16	MTX 220
ETN 322	Electrotechnics 322	16	EBN 111/122
IPB 320	Project Management 320	8	
	Total	72	

Recess training

MPY 315	Practical Training 315	16

Fourth year of study
First semester
Option – Mechanical and Aeronautical

Module		**Credits**	**Prerequisites**
MSY 411	Computer-aided Structural Mechanics 411	16	MSY 310 GS
MWX 410	Heat Transfer 410	16	MSX 310 GS, MTX 321 GS
MBB 410	Control Systems 410	16	MVR 320 GS
MOX 410	Design 410	16	MOW 312, 323
MSC 400	Project 400	8	Finalists only
BPE 451	Professional Ethics and Practice 451	8	
	Total	80	

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

Second semester
Option – Mechanical

MSC 400	Project 400	16	Finalists only
ETN 420	Electrotechnics 420	16	
MTV 420	Thermal and Fluid Machines 420	16	MSX 310 GS, MTX 321 GS
COM 420	Environmental Management 420	8	
	One elective from the following:		
MVE 420	Vehicle Engineering 420	16	
MLV 420	Aeronautics 420	16	MSX 310
MII 420	Maintenance Engineering 420	16	
	Total	72	

or

Option – Aeronautical

MSC 400	Project 400	16	Finalists only
ETN 420	Electrotechnics 420	16	
MLV 420	Aeronautics 420	16	MSX 310
MTV 420	Thermal and Fluid Machines 420	16	MSX 310 GS, MTX 321 GS
COM 420	Environmental Management 420	8	
	Total	72	

Recess Training

MPY 415	Practical Training 415	16

(h) Metallurgical Engineering

First year of study
First semester

Module		**Credits**	**Prerequisites**
MGC 110	Graphical Communication 110	16	
WTW 158	Calculus 158	16	
NMC 113	Materials Science 113	16	
EBN 111	Electricity and Electronics 111	16	
CIL 111	Computer Literacy 111	4	
SNV 111	Innovation 111	4	
	Total	72	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
FSK 176	Physics 176	16	
SWK 122	Mechanics 122	16	WTW 158
CHM 172	General Chemistry 172	16	
CIL 121	Information Literacy 121	4	
SNV 121	Innovation 121	4	SNV 111
	Total	72	

Recess training

WWP 121	Workshop Practice 121	6

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Students who failed the Academic Literacy Test must register for the module **JNV 100 (Innovation 100)**, which must be taken instead of the modules SNV 111 and SNV 121 (Innovation 111 and 121).

Second year of study

First semester

Module		**Credits**	**Prerequisites**
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
MSD 210	Dynamics 210	16	FSK 116/176, SWK 122, WTW 256†
MPR 212	Programming & Data Processing 212	16	CIL 111, 121
GMI 210	Mineralogy 210	16	
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	80	

Second semester

WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
BES 220	Engineering Statistics 220	8	
NMC 223	Materials Science 223	16	NMC 113/123
NPT 220	Process Thermodynamics 220	16	(CHM 171)
EIR 221	Electrical Engineering 221	16	EBN 111/122, WTW 161
	Total	80	

Third year of study

First semester

Module		**Credits**	**Prerequisites**
NHM 311	Hydrometallurgy 311	16	(NPT 220)
NMC 312	Materials Science 312	16	(NMC 222)
COP 311	Transfer Processes 311	16	CPS 311†
CPS 311	Pipe System Design 311	8	CRV 210, (NPT 220)
NVM 311	Refractory Materials 311	8	(NPT 220)
NEX 300	Excursions 300	8	
BIE 310	Engineering Economics 310	8	
	Total	80	

Second semester

NHM 321	Hydrometallurgy 321	16	(NPT 220), (NHM311)
NMM 320	Mechanical Metallurgy 320	16	(NMC 222)
NMP 323	Minerals Processing 323	16	
NPM 321	Pyrometallurgy 321	16	(NPT 220)

IPB 320	Project Management 320	8	
CHO 321	Heat Transfer 321	8	(COP 311)
	Total	80	

Recess training

NPY 316	Practical Training 316	16	

Fourth year of study
First semester

Module		**Credits**	**Prerequisites**
NKR 411	Corrosion 411	8	(NMM 320)
NPB 411	Process Metallurgy and Control 411	16	(NPM 321), (CHO 321)
NSC 411	Project 411	8	
BPE 451	Professional Ethics and Practice 451	8	
NHM 411	Hydrometallurgy 411	8	(NHM 321)
NPW 410	Metals Processing and Welding 410	16	(NMC 312), (NMM 320)
NMP 411	Minerals Processing 411	16	(NMP 323)
	Total	80	

Second semester

NSC 421	Project 421	44	NSC 411
NOP 420	Process Design 420	28	(NMP 411)
COM 420	Environmental Management 420	8	
	Total	80	

Recess training

NPY 416	Practical Training 416	16	

(i) Mining Engineering

First year of study
First semester

Module		**Credits**	**Prerequisites**
MGC 110	Graphical Communication 110	16	
WTW 158	Calculus 158	16	
NMC 113	Materials Science 113	16	
EBN 111	Electricity and Electronics 111	16	
CIL 111	Computer Literacy 111	4	
SNV 111	Innovation 111	4	
	Total	72	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
FSK 176	Physics 176	16	
SWK 122	Mechanics 122	16	WTW 158
CIL 121	Information Literacy 121	4	
SNV 121	Innovation 121	4	SNV 111
CHM 172	General Chemistry 172	16	
	Total	72	

Recess training

PWP 121	Workshop Practice 121	8

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Students who failed the Academic Literacy Test must register for the module **JNV 100 (Innovation 100)**, which must be taken instead of the modules SNV 111 and SNV 121 (Innovation 111 and 121).

Second year of study

First semester

Module		**Credits**	**Prerequisites**
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
MSD 210	Dynamics 210	16	FSK 116/176, SWK 122, WTW 256†
MPR 212	Programming & Data Processing 212	16	CIL 111, 121
SWK 210	Strength of Materials 210	16	SWK 122, WTW 168†
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	80	

Second semester

WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
BES 220	Engineering Statistics 220	8	
MTX 221	Thermodynamics 221	16	FSK 116/176
SUR 220	Surveying 220	16	
	Total	64	

Third year of study

First semester

.**Module**		**Credits**	**Prerequisites**
PRX 311	Rock Breaking 310	16	(PMY 210)
PDY 311	Surface Mining 311	16	PMY 121
PME 310	Mineral Economics 310	16	
GLY 151	Introductory Geology 151	8	
GLY 152	Physical Geology 152	8	
PNB 300	Industrial Excursions 300	8	
BIE 310	Engineering Economics 310	8	
	Total	80	

Second semester

PEE 320	Mine Environment Engineering 320	16	
PSZ 321	Rock Mechanics 321	16	SWK 210 GS
NMP 322	Minerals Processing 322	16	
GLY 161	Historical Geology 161	8	GLY 151 GS, 152 GS
GLY 162	Environmental Geology 161	8	GLY 151 GS, 152 GS

PSC 321	Introduction to Project 321	8
IPB 320	Project Management 320	8
	Total	80

Recess training

PPY 317	Practical Training 317	16

Fourth year of study

First semester

Module		**Credits**	**Prerequisites**
PEE 410	Mine Environmental Control Engineering 410	16	PEE 320
PSZ 410	Strata Control 410	16	PSZ 311
PSC 410	Project 410	8	PSC 321
BPE 451	Professional Ethics and Practice 451	8	
GLY 254	Structural Geology 254	12	GLY 152
PNB 400	Industrial Excursions 400	8	
PMY 410	Mining 410	16	PDY 311, PMY 210
	Total	84	

Second semester

PMZ 421	Mine Design 421	40	Finalists only PNB 300 PNB 400
GLY 361	Ore Deposits 361	18	
PMY 422	Mining 422	8	
COM 420	Environmental Management 420	8	
	Total	74	

Recess training

PPY 418	Practical Training 418	16

Eng. 15.2 Five-year Programmes

Please note:

i) The requirements for admission from the one year of study to the next are given in **Eng. 16, Eng. 17** and **Eng. 18**.

(ii) Only the curricula of the first, second and third years of study are given here. The curricula of the fourth and the fifth years of study are identical to those of the third and the fourth years of the Four-year Programmes and are given in **Eng. 15.1.**

(iii) A student who failed the Academic Literacy Test, but who is registered for and also passes in the modules JPO 110/120, will be exempted from the module JNV 100. If such a student should fail in the language component of JPO 120, it is required that the student registers for the module JNV 100 in the next year and passes in this module, after which credit for JPO 120 will be granted.

Faculty requirement

Module		**Credits**	**Prerequisites**
JCP 203	Community-based Project 203	8	

Notes
Students who register for the first year from 2005 will be required to successfully complete the above module 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.

(a) Chemical Engineering

First year of study
First semester

Module		**Credits**	**Prerequisites**
MGC 110	Graphical Communication 110	16	
CHM 171	General Chemistry 171	16	
WTW 158	Calculus 158	16	
*SNV 111	Innovation 111 **or**	4	
*JNV 100	Innovation 100 **or**	8	
*JPO 110	Professional Orientation 110	8	
	Total	52 **or** 56	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
CHM 181	General Chemistry 181	16	CHM 171
SWK 122	Mechanics 122	16	WTW 158
*SNV 121	Innovation 121 **or**	4	SNV 111
*JPO 120	Professional Orientation 120	8	JPO 110
	Total	52 **or** 56	

* See Note (ii) below.

Recess training

WWP 121	Workshop Practice 121	6

Notes
(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.
(ii) Depending on the results of the Academic Literacy Test and biographical information regarding educational background, students will be informed about the choice to be made between either SNV 111 and 121 **or** JNV 100 **or** JPO 110 and 120.

Second year of study
First semester

Module		**Credits**	**Prerequisites**
CIR 113	Chemical Engineering 113	8	
FSK 116	Physics 116	16	
CIL 111	Computer Literacy 111	4	
SWK 210	Strength of Materials 210	16	SWK 122, WTW 168†
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
	Total	60	

Second semester

CIL 121	Information Literacy 121	4	
CIR 123	Chemical Engineering 123	8	CHM 171, CIR 113
EBN 122	Electricity and Electronics 122	16	
WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
	Total	52	

Third year of study
First semester

Module		**Credits**	**Prerequisites**
CIR 211	Chemical Engineering 211	8	CIR 123, WTW 256†
CHM 215	Chemistry 215	16	CHM 171/172, 181
MPR 212	Programming & Data Processing 212	16	CIL 111, 121
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	56	

Second semester

CHM 226	Chemistry 226	8	CHM 171/172, 181
CTD 223	Thermodynamics 223	16	(CIR 211), MPR 212
BES 220	Engineering Statistics 220	8	
EIR 221	Electrical Engineering 221	16	EBN 111/122, WTW 161
	Total	48	

(b) Civil Engineering

First year of study
First semester

Module		**Credits**	**Prerequisites**
MGC 110	Graphical Communication 110	16	
CHM 171	General Chemistry 171	16	
WTW 158	Calculus 158	16	
*SNV 111	Innovation 111 **or**	4	
*JNV 100	Innovation 100 **or**	8	
*JPO 110	Professional Orientation 110	8	
	Total	52 **or** 56	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
NMC 123	Materials Science 123	16	
SWK 122	Mechanics 122	16	WTW 158
*SNV 121	Innovation 121 **or**	4	SNV 111
*JPO 120	Professional Orientation 120	8	JPO 110
	Total	52 **or** 56	

* See Note (ii) below.

Recess training

SWP 121	Workshop Practice 121	6

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Depending on the results of the Academic Literacy Test and biographical information regarding educational background, students will be informed about the choice to be made between either SNV 111 and 121 **or** JNV 100 **or** JPO 110 and 120.

Second year of study

First semester

Module		**Credits**	**Prerequisites**
FSK 116	Physics 116	16	
CIL 111	Computer Literacy 111	4	
SGM 210	Geomaterials and Processes 210	16	
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
	Total	52	

Second semester

EBN 122	Electricity and Electronics 122	16	
CIL 121	Information Literacy 121	4	
WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
	Total	44	

Third year of study

First semester

Module		**Credits**	**Prerequisites**
SWK 210	Strength of Materials 210	16	SWK 122, WTW 168†
SUR 210	Surveying 210	16	
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	48	

Second semester

SIN 223	Structural Analysis 223	16	WTW 168,161, SWK 210
SGM 221	Pavement Materials and Design 221	16	SGM 210 GS
BES 220	Engineering Statistics 220	8	
SBZ 221	Civil Engineering Measurement Techniques 221	8	
	Total	48	

(c) Computer Engineering

First year of study

First semester

Module		**Credits**	**Prerequisites**
COS 131	Introduction to Programming 131	16	

WTW 158	Calculus 158	16	
WST 111	Mathematical Statistics 111	16	
*SNV 111	Innovation 111 **or**	4	
*JNV 100	Innovation 100 **or**	8	
*JPO 110	Professional Orientation 110	8	
	Total	52 **or** 56	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
COS 121	Software Modeling 121	16	COS 131GS
EOS 284	Computer Architecture 284	16	COS 131
*SNV 121	Innovation 121 **or**	4	SNV 111
*JPO 120	Professional Orientation 120	8	JPO 110
	Total	52 **or** 56	

* See Note (i) below.

Recess training

EIW 121	Information Technology Practice 121	8

Note

(i) Depending on the results of the Academic Literacy Test and biographical information regarding educational background, students will be informed about the choice to be made between either SNV 111 and 121 **or** JNV 100 **or** JPO 110 and 120.

Second year of study

First semester

Module		**Credits**	**Prerequisites**
EBN 111	Electricity and Electronics 111	16	
CIL 111	Computer Literacy 111	4	
COS 121	Software Modeling 121	16	COS 131GS
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
	Total	52	

Second semester

WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
FSK 176	Physics 176	16	
CIL 121	Information Literacy 121	4	
	Total	44	

Recess training

EMR 100	Measurement Techniques and Computer Modelling 100	4	(CIL 111), (EBN 111)
EIW 221	Information Technology Practice 221	8	

Third year of study
First semester

Module		Credits	Prerequisites
COS 212	Data Structures & Algorithms 212	16	COS 131
EIR 211	Electrical Engineering 211	16	EBN 111/122, WTW 161
WST 111	Mathematical Statistics 111	16	
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	64	

Second semester

COS 222	Operating Systems 222	16	COS 131
ELI 220	Linear Systems 220	16	EIR 211
ERS 220	Digital Systems 220	16	
EOS 284	Computer Architecture 284	16	COS131
	Total	64	

(d) Electrical Engineering

First year of study
First semester

Module		Credits	Prerequisites
MGC 110	Graphical Communication 110	16	
CHM 171	General Chemistry 171	16	
WTW 158	Calculus 158	16	
*SNV 111	Innovation 111 **or**	4	
*JNV 100	Innovation 100 **or**	8	
*JPO 110	Professional Orientation 110	8	
	Total	52 **or** 56	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
NMC 123	Materials Science 123	16	
SWK 122	Mechanics 122	16	WTW 158
*SNV 121	Innovation 121 **or**	4	SNV 111
*JPO 120	Professional Orientation 120	8	JPO 110
	Total	52 **or** 56	

* See Note (ii) below.

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Depending on the results of the Academic Literacy Test and biographical information regarding educational background, students will be informed about the choice to be made between either SNV 111 and 121 **or** JNV 100 **or** JPO 110 and 120.

Second year of study
First semester

Module		Credits	Prerequisites
EBN 111	Electricity and Electronics 111	16	
CIL 111	Computer Literacy 111	4	
COS 131	Introduction to Programming 131	16	
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
	Total	52	

Second semester

FSK 176	Physics 176	16	
CIL 121	Information Literacy 121	4	
WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
	Total	44	

Recess training

EMR 100	Measurement Techniques and Computer Modelling 100	4	(CIL 111), (EBN 111)
EPW 200	Practical Wiring 200	4	

Third year of study
First semester

Module		Credits	Prerequisites
EIR 211	Electrical Engineering 211	16	EBN 111/122, WTW 161
MSD 210	Dynamics 210	16	FSK 116/176, SWK 122, WTW 256†
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
MGC 110	Graphical Communication 110	16	
	Total	64	

Second semester

ELI 220	Linear Systems 220	16	EIR 211
ERS 220	Digital Systems 220	16	
BES 220	Engineering Statistics 220	8	
	Total	40	

(e) Electronic Engineering

First year of study
First semester

Module		Credits	Prerequisites
MGC 110	Graphical Communication 110	16	
CHM 171	General Chemistry 171	16	
WTW 158	Calculus 158	16	
*SNV 111	Innovation 111 **or**	4	

*JNV 100	Innovation 100 **or**	8	
*JPO 110	Professional Orientation 110	8	
	Total	52 **or** 56	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
NMC 123	Materials Science 123	16	
SWK 122	Mechanics 122	16	WTW 158
*SNV 121	Innovation 121 **or**	4	SNV 111
*JPO 120	Professional Orientation 120	8	JPO 110
	Total	52 **or** 56	

* See Note (ii) below.

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Depending on the results of the Academic Literacy Test and biographical information regarding educational background, students will be informed about the choice to be made between either SNV 111 and 121 **or** JNV 100 **or** JPO 110 and 120.

Second year of study
First semester

Module		**Credits**	**Prerequisites**
EBN 111	Electricity and Electronics 111	16	
CIL 111	Computer Literacy 111	4	
COS 131	Introduction to Programming 131	16	
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
	Total	52	

Second semester

FSK 176	Physics 176	16	
CIL 121	Information Literacy 121	4	
WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
	Total	44	

Recess training

EMR 100	Measurement Techniques and Computer Modelling 100	4	(CIL 111), (EBN 111)

Third year of study
First semester

Module		**Credits**	**Prerequisites**
EIR 211	Electrical Engineering 211	16	EBN 111/122, WTW 161
MSD 210	Dynamics 210	16	FSK 116/176, SWK 122, WTW 256†
JSQ 216	Communication Skills 216	8	

JCP 203	Community-based Project 203	8	
MGC 110	Graphical Communication 110	16	
	Total	64	

Second semester

ELI 220	Linear Systems 220	16	EIR 211
ERS 220	Digital Systems 220	16	
BES 220	Engineering Statistics 220	8	
	Total	40	

(f) Industrial Engineering

First year of study
First semester

Module		**Credits**	**Prerequisites**
MGC 110	Graphical Communication 110	16	
CHM 171	General Chemistry 171	16	
WTW 158	Calculus 158	16	
*SNV 111	Innovation 111 **or**	4	
*JNV 100	Innovation 100 **or**	8	
*JPO 110	Professional Orientation 110	8	
	Total	52 **or** 56	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
NMC 123	Materials Science 123	16	
SWK 122	Mechanics 122	16	WTW 158
*SNV 121	Innovation 121 **or**	4	SNV 111
*JPO 120	Professional Orientation 120	8	JPO 110
	Total	52 **or** 56	

* See Note (ii) below.

Recess training

WWP 121	Workshop Practice 121	6

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Depending on the results of the Academic Literacy Test and biographical information regarding educational background, students will be informed about the choice to be made between either SNV 111 and 121 **or** JNV 100 **or** JPO 110 and 120.

Second year of study
First semester

Module		**Credits**	**Prerequisites**
FSK 116	Physics 116	16	
CIL 111	Computer Literacy 111	4	
WTW 258	Calculus 258	8	WTW 158,168

WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
MOW 217	Manufacturing and Design 217	16	MGC 110, SWK 122
	Total	52	

Second semester

CIL 121	Information Literacy 121	4	
EBN 122	Electricity and Electronics 122	16	
WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
	Total	44	

Third year of study
First semester

Module		**Credits**	**Prerequisites**
MPR 212	Programming & Data Processing 212	16	CIL 111, 121
MSD 210	Dynamics 210	16	SWK 122, FSK 116/176, WTW 256†
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	48	

Second semester

BES 220	Engineering Statistics 220	8	
BPZ 220	Productivity 220	16	
MTX 221	Thermodynamics 221	16	FSK 116/176
	Total	40	

(g) Mechanical Engineering

First year of study
First semester

Module		**Credits**	**Prerequisites**
MGC 110	Graphical Communication 110	16	
CHM 171	General Chemistry 171	16	
WTW 158	Calculus 158	16	
*SNV 111	Innovation 111 **or**	4	
*JNV 100	Innovation 100 **or**	8	
*JPO 110	Professional Orientation 110	8	
	Total	52 **or** 56	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
NMC 123	Materials Science 123	16	
SWK 122	Mechanics 122	16	WTW 158
*SNV 121	Innovation 121 **or**	4	SNV 111
*JPO 120	Professional Orientation 120	8	JPO 110
	Total	52 **or** 56	

* Electives (see Note (ii) below).

Recess training

WWP 121	Workshop Practice 121	6

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Depending on the results of the Academic Literacy Test and biographical information regarding educational background, students will be informed about the choice to be made between either SNV 111 and 121 **or** JNV 100 **or** JPO 110 and 120.

Second year of study

First semester

Module		**Credits**	**Prerequisites**
FSK 116	Physics 116	16	
CIL 111	Computer Literacy 111	4	
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
MOW 217	Manufacturing and Design 217	16	MGC 110, SWK 122
	Total	52	

Second semester

CIL 121	Information Literacy 121	4	
EBN 122	Electricity and Electronics 122	16	
WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
	Total	44	

Third year of study

First semester

Module		**Credits**	**Prerequisites**
MPR 212	Programming & Data Processing 212	16	CIL 111, 121
MSD 210	Dynamics 210	16	FSK 116/176, SWK 122, WTW 256†
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	48	

Second semester

BES 220	Engineering Statistics 220	8	
MOW 227	Machine Design 227	16	MOW 217
MTX 221	Thermodynamics 221	16	FSK 116/176
	Total	40	

(h) Metallurgical Engineering

First year of study

First semester

Module		**Credits**	**Prerequisites**
MGC 110	Graphical Communication 110	16	

CHM 171	General Chemistry 171	16	
WTW 158	Calculus 158	16	
*SNV 111	Innovation 111 **or**	4	
*JNV 100	Innovation 100 **or**	8	
*JPO 110	Professional Orientation 110	8	
	Total	52 **or** 56	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
NMC 123	Materials Science 123	16	
SWK 122	Mechanics 122	16	WTW 158
*SNV 121	Innovation 121 **or**	4	SNV 111
*JPO 120	Professional Orientation 120	8	JPO 110
	Total	52 **or** 56	

* See Note (ii) below.

Recess training

WWP 121	Workshop Practice 121	6

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Depending on the results of the Academic Literacy Test and biographical information regarding educational background, students will be informed about the choice to be made between either SNV 111 and 121 **or** JNV 100 **or** JPO 110 and 120.

Second year of study
First semester

Module		**Credits**	**Prerequisites**
FSK 116	Physics 116	16	
CIL 111	Computer Literacy 111	4	
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
GMI 210	Mineralogy 210	16	
	Total	52	

Second semester

EBN 122	Electricity and Electronics 122	16	
CIL 121	Information Literacy 121	4	
WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
	Total	44	

Third year of study
First semester

Module		**Credits**	**Prerequisites**
MPR 212	Programming & Data Processing 212	16	CIL 111, 121

MSD 210	Dynamics 210	16	FSK 116/176, SWK 122, WTW 256†
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	48	

Second semester

BES 220	Engineering Statistics 220	8	
NPT 220	Process Thermodynamics 220	16	(CHM 171/172)
EIR 221	Electrical Engineering 221	16	EBN 111/122, WTW 161
NMC 223	Materials Science 223	16	NMC 113/123
	Total	56	

(i) Mining Engineering

First year of study
First semester

Module		**Credits**	**Prerequisites**
MGC 110	Graphical Communication 110	16	
CHM 171	General Chemistry 171	16	
WTW 158	Calculus 158	16	
*SNV 111	Innovation 111 **or**	4	
*JNV 100	Innovation 100 **or**	8	
*JPO 110	Professional Orientation 110	8	
	Total	52 **or** 56	

Second semester

WTW 168	Calculus 168	8	WTW 158 GS
WTW 161	Linear Algebra 161	8	
NMC 123	Materials Science 123	16	
SWK 122	Mechanics 122	16	WTW 158
*SNV 121	Innovation 121 **or**	4	SNV 111
*JPO 120	Professional Orientation 120	8	JPO 110
	Total	52 **or** 56	

* See Note (ii) below.

Recess training

PWP 121	Workshop Practice 121	8

Notes

(i) Students may be promoted in Graphical Communication 110, if a semester test mark and a practicum mark of at least 65% each is obtained.

(ii) Depending on the results of the Academic Literacy Test and biographical information regarding educational background, students will be informed about the choice to be made between either SNV 111 and 121 **or** JNV 100 **or** JPO 110 and 120.

(iii) Five-year programme students may choose to do PWP 120 in the second year of study.

Second year of study
First semester

Module		Credits	Prerequisites
FSK 116	Physics 116	16	
CIL 111	Computer Literacy 111	4	
SWK 210	Strength of Materials 210	16	SWK 122, WTW 168†
WTW 258	Calculus 258	8	WTW 158,168
WTW 256	Differential Equations 256	8	WTW 158, WTW 161,168
	Total	52	

Second semester

EBN 122	Electricity and Electronics 122	16	
CIL 121	Information Literacy 121	4	
WTW 238	Mathematics 238	16	WTW 258, 256
WTW 263	Numerical Methods 263	8	WTW 161,168
	Total	44	

Third year of study
First semester

Module		Credits	Prerequisites
MPR 212	Programming & Data Processing 212	16	CIL 111, 121
MSD 210	Dynamics 210	16	FSK 116/176, SWK 122, WTW 256†
JSQ 216	Communication Skills 216	8	
JCP 203	Community-based Project 203	8	
	Total	48	

Second semester

BES 220	Engineering Statistics 220	8	
SUR 220	Surveying 220	16	
MTX 221	Thermodynamics 221	16	FSK 116/176
	Total	40	

REQUIREMENTS FOR PROMOTION TO THE FOLLOWING YEAR OF STUDY

Eng. 16
Promotion to the second semester of the first year and to the second year of study

(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 registered for the five-year programme who has passed the Professional Orientation module, but who has failed in all the other prescribed modules, is also not readmitted.

(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 of the first year of study, as well as students who are readmitted in terms of Regulation Eng. 16.(c) must register for the outstanding modules of the first year.

(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 enrol 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. 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 under "Summary of Syllabi: Bachelor of Engineering" elsewhere in this publication: (PWP 121) Workshop Practice 121.

Eng. 17

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 Five-year Programme. In case of the fourth year of study of the Five-year Programme, the words "first", "second" and "third" must be substituted with the words "second", "third" and "fourth" respectively.

(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 of the first year of study, before he or she is admitted to any module of the third year of study.

(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 enrol 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 under "Summary of Syllabi: Bachelor of

Engineering" elsewhere in this publication: (PWP 120) Workshop Practice 120, as well as (PPY 317) Practical Training 317.

Eng. 18
Promotion to the fourth year of study of the Four-year Programme, as well as to the fifth year of study of the Five-year Programme. In case of the fifth year of study of the Five-year Programme, the words "second", "third" and "fourth" must be substituted with the words "third", "fourth" and "fifth" respectively.

(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.

REGULATIONS FOR POSTGRADUATE PROGRAMMES IN THE SCHOOL OF ENGINEERING AND THE GRADUATE SCHOOL OF TECHNOLOGY MANAGEMENT

BACHELOR OF ENGINEERING (HONOURS) [BEng(Hons)]

Eng. 19
Also consult the General Regulations G.16 to G.29.

(a) Subject to the stipulations of Reg. G.1.3 and G.62, a BEng degree or equivalent qualification is required for admission.
(b) The minimum duration of the programme is one year of full-time study.
(c) 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.
(d) The degree is awarded in the following fields of engineering:

(i)	Bioengineering	(Code 12240201)
(ii)	Chemical Engineering	(Code 12240021)
(iii)	Computer Engineering	(Code 12240211)
(iv)	Control Engineering	(Code 12240231)
(v)	Electrical Engineering	(Code 12240031)
(vi)	Electronic Engineering	(Code 12240091)
(vii)	Environmental Engineering	(Code 12240221)
(viii)	Geotechnical Engineering	(Code 12240212)
(ix)	Industrial Engineering	(Code 12240011)
(x)	Mechanical Engineering	(Code 12240051)

(xi) Metallurgical Engineering (Code 12240061)
(xii) Microelectronic Engineering (Code 12240191)
(xiii) Mining Engineering (Code 12240071)
(xiv) Software Engineering (Code 12240202)
(xv) Structural Engineering (Code 12240121)
(xvi) Technology Management (Code 12240251)
(xvii) Transportation Engineering (Code 12240111)
(xviii) Urban Engineering (Code 12240213)
(xix) Water Resources Engineering (Code 12240161)
(xx) Water Utilisation Engineering (Code 12240101)

(e) The degree is awarded on the basis of examinations only.

(f) **Examinations**

(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. November/January or June/July).

(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.

(g) 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).

(h) **Credit for modules**
Consult General Regulation G.23

MASTER OF ENGINEERING (MEng)
MASTER OF SCIENCE (ENGINEERING MANAGEMENT)
[MSc(Engineering Management)]
MASTER OF SCIENCE (PROJECT MANAGEMENT)
[MSc(Project Management)]

Eng. 20
Also consult the General Regulations G.30 to G.44. and G.57 to G.62

(a) Subject to the stipulations of Reg. G.1.3 and G.62, a BEng(Hons) degree or equivalent qualification is required for admission to the MEng programmes [excluding the MEng(Engineering Management) and the MEng(Project Management)]. The admission requirement for the MEng(Engineering Management) and the MEng(Project Management) is a BEng or equivalent qualification. The admission requirement for the MSc(Engineering Management) and the MSc(Project Management) is a BSc(Hons) or equivalent qualification.

(b) The minimum duration of the MEng programmes [excluding the MEng(Engineering Management) and the MEng(Project Management)] is one year of full-time study.

The programmes in MEng(Engineering Management), MEng(Project Management), MSc(Engineering Management) and the MSc(Project Management) can be completed in a minimum period of two years.

(c) A minimum of 128 credits is required to obtain the MEng degree [excluding the MEng(Engineering Management) and the MEng(Project Management)]. Either a project (64 credits) and coursework (64 credits) **or** a dissertation (128 credits) is included in the programme. A minimum of 256 credits is required for the MEng(Engineering Management), MEng(Project Management), MSc(Engineering Management) and the MSc(Project Management), including a project (64 credits) and coursework(192 credits).

(d) Recognition is not granted for credits acquired during studying for the BEng(Hons) or the BSc(Hons).

(e) The degree Master of Engineering is awarded in the following fields of engineering:

		Degree code	Dissertation	Degree code	Project
(i)	Bioengineering	12250201	EIB 890		
(ii)	Chemical Engineering	12250021	CVD 800	12256021	CSC 800
(iii)	Computer Engineering	12250211	ERI 890		
(iv)	Control Engineering	12250231	CVD 800	12256231	CSC 800
(v)	Electrical Engineering	12250031	EIR 890		
(vi)	Electronic Engineering	12250091	EIN 890		
(vii)	Engineering Management			12250172	IGB 898
(viii)	Environmental Engineering	12250221	CVD 800	12256221	CSC 800
(ix)	Geotechnical Engineering	12250212	SGI 890	12256212	SGT 896
(x)	Industrial Engineering	12250011	BIR 890		
(xi)	Mechanical Engineering	12250051	MIR 890		
(xii)	Metallurgical Engineering	12250061	NIN 890		
(xiii)	Microelectronic Engineering	12250191	EEY 890		
(xiv)	Mining Engineering	12250071	PYI 890		
(xv)	Software Engineering	12250202	EPR 890		
(xvi)	Project Management			12250262	IGB 898
(xvii)	Structural Engineering	12250121	SIN 890	12256121	SIN 896
(xviii)	Technology Management	12250251	ITB 890	12250252	IGB 898
(xix)	Transportation Engineering	12250111	SVI 890	12256111	SVI 896
(xx)	Urban Engineering	12250213	SSI 890	12256213	SSI 896
(xxi)	Water Utilisation Engineering	12250101	CVD 800	12256101	CSC 800
(xxii)	Water Resources Engineering	12250161	WBK 890	12256161	SSC 890

(f) 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 project **or** a dissertation (including an examination on the dissertation).

(g) The curriculum is determined in consultation with the relevant Head of Department.

(h) **Examinations**

(i) The stipulations of Eng. 19 (f)(i), (iii), (iv) and (v) are applicable.

(ii) An MEng student [excluding the MEng(Engineering Management) and the MEng(Project Management)] is required to complete his or her degree studies within three years after the first registration: Provided that the Dean, in consultation with the relevant Head of Department, may, in exceptional circumstances, approve a stipulated limited extension of this period.

(iii) A student for an MEng(Engineering Management), MEng(Project Management), MSc(Engineering Management) or an MSc(Project Management) is required to complete his or her degree studies within four years after the first registration: Provided that the Dean, in consultation with the relevant Head of Department, may, in exceptional circumstances, approve a stipulated limited extension of this period.

(iv) The Dean may, on recommendation of the relevant Head of Department, exempt a student from the examination on the dissertation.

(i) Guidelines for the preparation and examination of projects 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%.

(j) **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 project, 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 project. However, the degree is not awarded with distinction should a student fail any of these modules (excluding modules which have been timeously dis-continued). The degree is also not awarded with distinction if a student obtains less than 70% for the project.

(k) **General master's degree requirements and draft article**

A student must by means of a dissertation or project 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 recognized 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.

CURRICULA FOR THE BEng(Hons), MEng, MSc(Engineering Management) AND MSc(Project Management) PROGRAMMES

Eng. 21

Any specific module is offered on condition that a minimum number of students are registered for the module, as determined by the Head of the 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.

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

(a) CHEMICAL ENGINEERING

A limited number of appropriate modules from other departments and from other divisions of Chemical Engineering are allowed.

BEng(Hons)(Chemical Engineering)(12240021)

	Code	Credits
Carbon Materials Science and Technology 732	CMS 732	32
Chemical Engineering 702	CIR 702	32
Polymer Materials Science 732	CPW 732	32
Polymer Processing 732	CPP 732	32
Process Integration 732	CIP 732	32
Product Design 732	CPO 732	32
Reactor Design 700	CRO 700	32
Separation Technology 732	CSK 732	32
Surfactant Technology 732	CYM 732	32
Reactor Hydrodynamics 732	CRH 732	32

BEng(Hons)(Control Engineering)(12240231)

	Code	Credits
Model-based Control Laboratory 732	CML 732	32
Multivariable Control System Design 700	CBO 700	32
Multivariable Control System Theory 700	CBT 700	32
Process Control System Development 732	CSP 732	32

BEng(Hons)(Environmental Engineering)(12240221)

	Code	Credits
Air Management 780	CAM 780	32
Environmental Management 780	CEM 780	32
Waste Management 780	WAI 780	32
Water Quality Management 780	WQB 780	32

BEng(Hons)(Water Utilisation Engineering)(12240101)

	Code	Credits
Biological Water Treatment 780	WBW 780	32
Chemical Water Treatment 780	WCW 780	32
Water Quality Management 780	WQB 780	32
The remaining 32 credits may be taken by selecting one of the following relevant modules:		
Waste Management 780	WAI 780	32
Process Integration 732	CIP 732	32
Separation Technology 732	CSK 732	32

MEng(Chemical Engineering)(12250021)
MEng(Control Engineering)(12250231)
MEng(Environmental Engineering)(12250221)
MEng(Water Utilisation Engineering)(12250101)

	Code	Credits
Dissertation 800	CVD 800	128

or
Only for:
MEng(Water Utilisation Engineering)(12256101)

Project 800	CSC 800	64
and *64 credits from the following:*		
Chemical Engineering 800	CIR 800	32
Plant Design 800	CAO 800	32
Plant Design 810	CAO 810	32

(b) CIVIL ENGINEERING

A limited number of appropriate modules from other departments or from other divisions of Civil Engineering are allowed.

BEng(Hons)(Water Resources Engineering)(12240101)
128 credits from the following:

	Code	**Credits**
At least 96 credits from the following:		
Statistical Methods 791	SHC 791	24
Flood Hydrology 792	SHC 792	24
Hydraulic Design 793	SHC 793	24
Free Surface Flow 794	SHC 794	24
Pipe Flow 795	SHC 795	24
Pump Systems 785	SHW 785	24
Water Resource Analysis and Management 796	SHC 796	24
and		
the remainder of the credits from the following:		
Pavement Design 793	SGC 793	24
Concrete Technology 794	SGC 794	24
Reinforced Concrete Design 778	SIN 778	24
Geotechnical Design Special 795	SGC 795	24
Civil Engineering Special 792	SGC 792	24
Maintenance Special 780	SVC 780	24
or		
the balance of the credits may also elected from the following electives presented by the Department of Chemical Engineering:		
Environmental Management 780	CEM 780	32
Air Management 780	CAM 780	32
Water Quality Management 780	WQB 780	32
Chemical Water Treatment 780	WCW 780	32
Biological Water Treatment 780	WBW 780	32
Waste Management 780	WAI 780	32

BEng(Hons)(Geotechnical Engineering)(12240212)
128 credits from the following:

	Code	**Credits**
Core modules:		
Geotechnical Design Special 795	SGC 795	24
Soil Mechanics Special 784	SGM 784	24
Geotechnical Laboratory Testing 785	SGS 785	24
In-situ Soil Testing and Monitoring 786	SGS 786	24

Statistical Methods 791	SHC 791	24
Electives:		
Engineering Geology 703	IGL 703	16
Engineering Geology 704	IGL 704	16
Civil Engineering Special 792	SGC 792	24
Pavement Design 793	SGC 793	24
Concrete Technology 794	SGC 794	24

BEng(Hons)(Urban Engineering)(12240213)
This degree will not be presented as from 2009.
128 credits in consultation with the Head of the Department to enable students currently registered to complete the degree.

BEng(Hons)(Structural Engineering)(12240121)
128 credits from the following:

	Code	**Credits**
At least 96 credits from the following:		
Steel Design 776	SIN 776	24
Structural Mechanics 777	SIN 777	24
Reinforced Concrete Design 778	SIN 778	24
Timber Design 779	SIN 779	24
Structural Analysis 790	SIN 790	24
Prestressed Concrete Design 791	SIN 791	24
and		
the remainder of the credits from the following:		
Hydraulic Design 793	SHC 793	24
Concrete Technology 794	SGC 794	24
Geotechnical Design Special 795	SGC 795	24
Statistical Methods 791	SHC 791	24
Civil Engineering Special 792	SGC 792	24

An approved module from the Department of Mathematics and Applied Mathematics.
An approved module from the Department of Mechanical and Aeronautical Engineering.

BEng(Hons)(Transportation Engineering)(12240111)
128 credits from the following:

	Code	**Credits**
Core modules:		
Transportation Planning 789	SVC 789	24
Statistical Methods 791	SHC 791	24
Electives:		
Asphalt Technology 798	SGC 798	24
Pavement Design 793	SGC 793	24
Stabilised Materials and Compaction 796	SGC 796	24
Road Rehabilitation Technology 797	SGC 797	24
Traffic Engineering 792	SVC 792	24
Multimodal Transport 788	SVV 788	24
Geometric Design and Safety 791	SVV 791	24
Concrete Technology 794	SGC 794	24
Transportation Studies 790	SVC 790	24
Transportation Special 791	SVC 791	24
Maintenance Special 780	SVC 780	24
Civil Engineering Special 792	SGC 792	24

MEng(Water Resources Engineering)(12250161)

	Code	Credits
Dissertation 890	WBK 890	128

or

MEng(Water Resources Engineering)(12256161)

Project 890	SSC 890	64
and *64 credits from the following:*		
Computer Applications for Civil Engineers 880	SHC 880	32
Advanced Hydraulics 885	SHC 885	32

MEng(Geotechnical Engineering)(12250212)

	Code	Credits
Dissertation 890	SGI 890	128

MEng(Structural Engineering)(12250121)

	Code	Credits
Dissertation 890	SIN 890	128

or

MEng(Structural Engineering)(12256121)

Project 896	SIN 896	64
and *64 credits from the following:*		
Computer Applications in Civil Engineering 880	SHC 880	32
Advanced Structural Design 886	SIN 886	32
Advanced Structural Analysis 887	SIN 887	32

An approved module from the Department of Mechanical and Aeronautical Engineering.

MEng(Transportation Engineering)(12250111)

	Code	Credits
Dissertation 890	SVI 890	128

or

MEng(Transportation Engineering)(12256111)

Project 896	SVI 896	64
and *64 credits from the following:*		
Advanced Transportation I 882	SVV 882	32
Advanced Transportation II 883	SVV 883	32
Computer Applications in Civil Engineering 880	SHC 880	32

(c) ELECTRICAL, ELECTRONIC AND COMPUTER ENGINEERING

BEng(Hons)(Electrical Engineering)(12240031)

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.

	Code	Credits
Energy Management 732	EES 732	32
Power Distribution Engineering 732	EEV 732	32
Power Electronics 780	EED 780	32
Power Network Stability 732	EKE 732	32
Introduction to Research 732	EIN 732	32

Advanced Topics in Energy Research 732	ERT 732	32
Energy Optimisation 732	ENO 732	32

BEng(Hons)(Electronic Engineering)(12240091)
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.

	Code	**Credits**
Adaptive Systems 732	ETA 732	32
Advanced Microprocessor System Design 732	ERV 780	32
Antenna Theory 780	EMA 780	32
Coding Theory 732	ETK 732	32
Detection and Estimation 732	EOP 732	32
Digital Communications 732	ETD 732	32
Digital Radio Techniques 732	ESR 732	32
Electro Optics 732	EEO 732	32
Introduction to Research 732	EIN 732	32
Microwave Theory 780	EMM 780	32
Mobile Communications 732	ETR 732	32
Multivariable Control Systems 732	EMB 732	32
Optical Communication 732	EFO 732	32
Optimal Control 780	EBO 780	32
Pattern Recognition and Neural Networks 732	EPP 732	32
Telecommunication Systems Engineering 732	ETT 732	32
Theory of Bayesian Inference 732	ETB 732	32
Cellular Wireless Telephony 710	ECW 710	32
Introduction to the Science of Measurement 716	EIS 716	16
Introductory Radiometry and Photometry 716	ERD 716	16
Interferometry 716	EFR 716	16
Optical Networking 716	ENW 716	16
Advanced Classical Optics 732	EAD 732	32
Electro-Optical Systems Design 732	ESD 732	32
Optical Design 732	EOD 732	32
Topics in Photonics 732	ETP 732	32

BEng(Hons)(Computer Engineering)(12240211)
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.

	Code	**Credits**
Advanced Microprocessor System Design 780	ERV 780	32
Computer Networks 780	ERN 780	32
Detection and Estimation 732	EOP 732	32
Information Security 780	ETH 780	32
Introduction to Research 732	EIN 732	32
New Generation Networks 732	ERC 732	32
Pattern Recognition and Neural Networks	EPP 732	32
Software Architecture 780	ERA 780	32
Software Construction 732	ERD 732	32
Software Management and Economics 780	ERS 780	32
Theory of Bayesian Inference 732	ETB 732	32
Wireless Sensor Networks 732	EKS 732	32

BEng(Hons)(Bioengineering)(12240201)
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 enrol for a master's or a PhD in Bioengineering.

	Code	Credits
Bioelectricity and Electronics 732	EBE 732	32
Bioelectromagnetism and Modelling 732	EBI 732	32
Biosignals and Systems 732	EBB 732	32
Introduction to Research 732	EIN 732	32

BEng(Hons)(Microelectronic Engineering)(12240191)
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.

	Code	Credits
Analogue Electronic Design 732	EME 732	32
Communication Electronics 732	EMK 732	32
Digital Electronic Design 780	EDG 780	32
Introduction to Research 732	EIN 732	32

BEng(Hons)(Software Engineering)(12240202)
Students may take modules to the value of 32 credits from other fields of specialisation or from other departments, instead of the module Introduction to Research 732 (EIN 732), with approval of the Coordinator: Postgraduate Studies. However, if a student wants to proceed to the MEng(Software Engineering) degree, the module Introduction to Researdh 732 (EIN 732) is mandatory.
It is compulsory for all students registered for the BEng(Hons)(Software Engineering) degree to complete all three the software modules (ERA 732, ERD 732 and ERS 732).

Code	Credits	
Software Architecture 780	ERA 780	32
Software Construction 732	ERD 732	32
Software Management and Economics 780	ERS 780	32
Introduction to Research 732	EIN 732	32

MEng(Electrical Engineering)(12250031)

	Code	Credits
Dissertation 890	EIR 890	128

MEng(Electronic Engineering)(12250091)

	Code	Credits
Dissertation 890	EIN 890	128

MEng(Computer Engineering)(12250211)

	Code	Credits
Dissertation 890	ERI 890	128

MEng(Bioengineering)(12250201)

	Code	Credits
Dissertation 890	EIB 890	128

MEng(Microelectronic Engineering)(12250191)

	Code	Credits
Dissertation 890	EEY 890	128

MEng(Software Engineering)(12250202)

	Code	Credits
Dissertation 890	EPR 890	128

(d) ENGINEERING AND TECHNOLOGY MANAGEMENT

BEng(Hons)(Technology Management)(12240251)
128 credits from the following:

	Code	Credits
Core modules:		
Decision Analysis 780	IBD 780	16
Technology and Innovation Management 780	ITI 780	16
Project Management 780	IPK 780	16
Systems Engineering 780	ISE 780	16
Operations Management 781	IVV 781	16
Technological Entrepreneurship 780	IEE 780	16
Research Methodology 781	INM 781	16
and		
Electives /Ad hoc modules		
Maintenance Management 780	IMC 780	16
Engineering Logistics 780	IIX 780	16
Quality Management 780	IKK 780	16
(Contact department for more information)		

MEng(Technology Management)(12250251)
This qualification follows upon the BEng(Hons)(Technology Management).

	Code	Credits
Dissertation 890	ITB 890	128
or		

MEng(Technology Management)(12250252)

Project 898	IGB 898	64
People Management 884	PEM 884	16
Financial Management 831	FBS 831	16
Strategic Management 802	ISM 802	16
and		
Elective module		
Technology Commercialisation 881	IBM 881	16

or
Module from the MEM/MPM programme (subject to the approval of the head of department)

MEng(Engineering Management)(12250172)
MSc(Engineering Management)(12251074)
Minimum requirements: 192 credits of course-based modules and a project (64 credits).
Total: 256 credits.

	Code	Credits
Project 898 (MEng)	IGB 898	64
Project 898 (MSc)	ISC 898	64
and		
Core modules		
Systems Engineering and Management 801	ISE 801	16
Production and Operations Management 801	IPP 801	16
People Management 883	PEM 883	16
Financial Management 830	FBS 830	16
Technology Management 801	ITB 801	16
Maintenance Management 801	IIB 801	16
Project Management 803	IPK 803	16
Strategic Management 801	ISM 801	16
and		
Domain: General		
Quality Management 801	IKK 801	16
Decision Analysis 804	IBD 804	16
Marketing Management 884	BEM 884	16
Electives		
New Ventures and Entrepreneurship 801	IOE 801	16
Engineering Logistics 801	IIX 801	16
Life Cycle Management of SHE 802	ILE 802	16
Information Management 884	ILB 884	16
or		
Domain: Asset and Maintenance Management		
Life Cycle Management of SHE 802	ILE 802	16
Asset Management 801	IAM 801	16
Risk Management 801	IRI 801	16
Electives		
Reliability Engineering 801	IBI 801	16
Engineering Logistics 801	IIX 801	16
Information Management 884	ILB 884	16
or		
Domain: Fixed Asset Civil		
Life Cycle Management of SHE 802	ILE 802	16
Risk Management 801	IRI 801	16
Elective module from Civil Engineering		16
or		
Domain: Life-cycle Management		
Life Cycle Management of SHE 802	ILE 802	16
Marketing Management 884	BEM 884	16
Electives		
Asset Management 801	IAM 801	16
Risk Management 801	IRI 801	16
New Ventures and Entrepreneurship 801	IOE 801	16
Engineering Logistics 801	IIX 801	16
Information Management 884	ILB 884	16

MEng(Project Management)(12250262)
MSc(Project Management)(12251075)
Minimum requirements: 192 credits of course-based modules and a project (64 credits). Total: 256 credits.

	Code	Credits
Project 898 (MEng)	IGB 898	64
Project 898 (MSc)	ISC 898	64
and		
Core modules		
Project Systems Engineering 802	ISE 802	16
Introduction to Project Management 801	IPM 801	16
Project Human Resource Management 801	IHR 801	16
Project Finance and Cost Management 802	IPF 802	16
Project Procurement Management 801	IPJ 801	16
Project Quality Management 801	IQM 801	16
Legal Aspects of Project Management 803	ILC 803	16
Strategic Project Management 804	ISM 804	16
and		
Domain: General		
Project Risk Management 801	IRM 801	16
Project Management Practice 801	IMP 801	16
Electives		
New Ventures and Entrepreneurship 801	IOE 801	16
Engineering Logistics 801	IIX 801	16
Marketing Management 884	BEM 884	16
Life Cycle Management of SHE 802	ILE 802	16
Information Management 884	ILB 884	16
or		
Domain: Asset and Maintenance Management		
Life Cycle Management of SHE 802	ILE 802	16
Asset Management 801	IAM 801	16
Risk Management 801	IRI 801	16
Electives		
Reliability Engineering 801	IBI 801	16
Engineering Logistics 801	IIX 801	16
Information Management 884	ILB 884	16
or		
Domain: Fixed Asset Civil		
Life Cycle Management of SHE 802	ILE 802	16
Risk Management 801	IRI 801	16
Elective Module from Civil Engineering		16
or		
Domain: Life-cycle Management		
Life Cycle Management of SHE 802	ILE 802	16
Project Management Practice 801	IMP 801	16
Electives		
Marketing Management 884	BEM 884	16
Asset Management 801	IAM 801	16
New Ventures and Entrepreneurship 801	IOE 801	16
Engineering Logistics 801	IIX 801	16
Information Management 884	ILB 884	16

(e) INDUSTRIAL AND SYSTEMS ENGINEERING

A limited number of appropriate modules from other departments are allowed.

BEng(Hons)(Industrial Engineering)(12240011)

	Code	Credits
Business Architecture 780	BBA 780	16
Business Engineering 780	BSI 780	16
Business Logistics 780	BLK 780	16
Ergonomics 780	BEE 780	16
Health and Safety in the Workplace 780	BGW 780	16
Industrial Analysis 780	BAN 780	16
Information Systems 780	BIS 780	16
Megatronics 780	BMK 780	16
Operations Research 780	BOZ 780	16
Probability Models 780	BHM 780	16
Production Management 781	BPZ 781	16
Quality Management 780	BGH 780	16
Reliability Engineering 780	BTH 780	16
Research Methodology 781	INM 781	16
Simulation Modelling 780	BUY 780	16
Supply Chain Design 780	BVK 780	16

MEng(Industrial Engineering)(12250011)

	Code	Credits
Dissertation 890	BIR 890	128

(f) MATERIALS SCIENCE AND METALLURGICAL ENGINEERING

A limited number of appropriate modules from other departments are allowed.

BEng(Hons)(Metallurgical Engineering)(12240061)

	Code	Credits
Corrosion 700	NKR 700	32
Electrometallurgy 700	NEL 700	32
Froth Flotation 700	NSF 700	32
Heat Treatment 700	NHB 700	32
Hydrometallurgy 700	NHM 700	32
Literature Survey 700	NLO 700	32
Mechanical Metallurgy 700	NMM 700	32
Metallurgical Analysis 700	NPA 700	32
Minerals Processing 700	NMP 700	32
Physical Metallurgy 700	NFM 700	32
Pyrometallurgy 700	NPM 700	32
Refractory Materials 700	NVM 700	32
Welding Metallurgy 700	NSW 700	32

MEng(Metallurgical Engineering)(12250061)

	Code	Credits
Dissertation 890	NIN 890	128

(g) MECHANICAL AND AERONAUTICAL ENGINEERING

A limited number of appropriate modules from other departments are allowed.

BEng(Hons)(Mechanical Engineering)(12240051)
Modules are selected in consultation with the Head of the Department, in order to specialise in one of the following fields:
Aeronautical Engineering
Design
Dynamics
Fluids and Thermoflow
Structural Mechanics
Vehicle Engineering

	Code	Credits
Advanced Fluid Mechanics 732	MGM 732	32
Advanced Heat and Mass Transfer 732	MHM 732	32
Advanced Vehicle Engineering 732	MGV 732	32
Aircraft Design 780	MLW 780	16
Condition-based Maintenance 732	MIC 732	32
Design 732	MOX 732	32
Finite Element Methods 732	MEE 732	32
Flight Mechanics 780	MLV 780	16
Gas Dynamics and Aircraft Propultion Systems 732	MGA 732	32
Independent Study 732	MSS 732	32
Independent Study 781	MSS 781	16
Numerical Techniques and Optimisation 732	MNO 732	32
Numerical Thermoflow 732	MSM 732	32
Structural Integrity 732	MSI 732	32
Tribology 732	MIT 732	32
Vibration 732	MEV 732	32

MEng(Mechanical Engineering)(12250051)

	Code	Credits
Dissertation 890	MIR 890	128

(h) MINING ENGINEERING

A limited number of appropriate modules from other departments are allowed.

BEng(Hons)(Mining Engineering)(12240071)

	Code	Credits
Advanced Mine Design 780	PMZ 780	16
Airflow and Fans 711	PKB 711	16
Financial Mine Evaluation 780	PFZ 780	16
Guided Special Studies 700	PSS 700	32
Heat and Refrigeration 712	PKB 712	16
Slope Stability 781	PHS 781	16
Strata Control – Collieries 788	PSZ 788	16
Strata Control – Hard Rock Mining 786	PSZ 786	16
Surface Mining 783	POY 783	16
Rock Breaking 785	PRX 785	16

MEng(Mining Engineering)(12250071)

	Code	Credits
Dissertation 890	PYI 890	128

(i) MODULES FROM OTHER DEPARTMENTS

Postgraduate modules offered by the **Department of Geology:**

Engineering Geology 703	IGL 703
Engineering Geology 704	IGL 704

Postgraduate modules offered by the **Department of Mathematics and Appplied Mathematics:**

First semester	
Mathematical Models of Financial Engineering 732	WTW 732
Second semester	
Mathematical Models of Financial Engineering 762 (Prerequisite: WTW 732)	WTW 762

Postgraduate modules offered by the **Department of Computer Science:**

Computer Networks 780	RNW 780
Graphics 780	GRF 780
Office Systems 715	KAS 715
Programming Languages 780	PGT 780
Software Engineering 780	PIN 780

BACHELOR OF SCIENCE (HONOURS) IN APPLIED SCIENCE
[BSc(Hons)(Applied Science)]
BACHELOR OF SCIENCE (HONOURS) IN TECHNOLOGY MANAGEMENT
[BSc(Hons)(Technology Management)]

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Also consult the General Regulations G.16 to G.29.

(a) Admission requirements: An appropriate bachelor's degree, a BTech degree or equivalent qualification.
(b) The minimum duration of the programme is one year of full-time study.
(c) A minimum of 128 credits is required to obtain the BSc(Hons) degree.
(d) The BSc(Hons)(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
(e) The BSc(Hons)(Technology Management) degree is conferred by the following academic department:
Engineering and Technology Management
(f) The stipulations of Reg. Eng. 19 (e) to (g) apply mutatis mutandis.

MASTER OF SCIENCE IN APPLIED SCIENCE
[MSc(Applied Science)]
MASTER OF SCIENCE IN TECHNOLOGY MANAGEMENT [MSc(Technology Management)]

Eng. 23
Also consult the General Regulations G.30 to G.44. and G.57 to G.62
(a) Subject to the stipulations of Regulation G.62, an appropriate BSc(Hons) or equivalent degree is required for admission.
(b) The minimum duration of the programme is one year of full-time study.
(c) The MSc(Applied Science) degree is conferred by the same departments as the BSc(Hons)(Applied Science) degree. The MSc(Technology Management) degree is conferred by the Department of Engineering and Technology Management.
(d) A minimum of 128 credits is required to obtain the MSc degree. Either a project (64 credits) and coursework (64 credits) **or** a dissertation (128 credits) is included in the programme.
(e) The stipulations of Regulation Eng. 20 (f) to (k) apply mutatis mutandis, excluding the stipulations applicable to the MEng(Engineering Management), MEng(Project Management), MSc(Engineering Management) and the MSc(Project Management).

CURRICULA FOR THE BSc(Hons)(Applied Science), BSc(Hons)(Technology Management), MSc(Applied Science) AND THE MSc(Technology Management) PROGRAMMES

Eng. 24
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 the 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.

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

(a) CHEMICAL ENGINEERING

A limited number of appropriate postgraduate modules from other departments are allowed.

BSc(Hons)(Applied Science)(Control)(12243012)

	Code	**Credits**
At least 64 credits from the following:		
Process Control 410	CPB 410	16
Chemical Engineering 412	CIR 412	16
Process Synthesis 410	CPS 410	16
Practice 420	CPR 420	16
Specialisation 420	CSS 420	16
The modules above must be passed before any of the following modules can be registered:		
Process Control System Development 732	CSP 732	32
Separation Technology 732	CSK 732	32
Process Integration 732	CIP 732	32

BSc(Hons)(Applied Science)(Chemical Technology)(12243015)

	Code	Credits
Option: Carbon and Polymer Materials Science and Chemical Product Design - 128 credits from the following:		
Polymer Materials Science 732	CPW 732	32
Polymer Processing 732	CPP 732	32
Separation Technology 732	CSK 732	32
Chemical Engineering 707	CIR 707	32
Additive Technology 732	CYM 732	32
Carbon Materials Science and Technology 732	CMS 732	32
Product Design 732	CPO 732	32
Option: Process Design - 128 credits from the following:		
Reactor Design 410	CRO 410	16
Process Control 410	CPB 410	16
Chemical Engineering 412	CIR 412	16
Process Synthesis 410	CPS 410	16
Practice 420	CPR 420	16
Specialisation 420	CSS 420	16
Product Design 732	CPO 732	32
Separation Technology 732	CSK 732	32
Process Integration 732	CIP 732	32

BSc(Hons)(Applied Science)(Environmental Technology)(12243025)

	Code	Credits
The following 128 credits are prescribed:		
Environmental Management 787	CEM 787	32
Air Management 787	CAM 787	32
Water Quality Management 787	WQB 787	32
Waste Management 787	WAI 787	32

BSc(Hons)(Applied Science)(Water Utilisation)(12243029)

	Code	Credits
The following 128 credits are prescribed:		
Chemical Water Treatment 787	WCW 787	32
Biological Water Treatment 787	WBW 787	32
Water Quality Management 787	WQB 787	32
Waste Management 787	WAI 787	32

MSc(Applied Science)(Control)(12253012)
MSc(Applied Science)(Chemical Technology)(12253015)
MSc(Applied Science)(Environmental Technology)(12253025)
MSc(Applied Science)(Water Utilisation)(12253029)

	Code	Credits
Dissertation 807	CVD 807	128

or

MSc(Applied Science)(coursework)(12253051)
(only available for specialisation in Water Utilisation)

Project 807	CSC 807	64
and *64 credits from the following:*		
Chemical Engineering 807	CIR 807	32
Plant Design 807	CAO 807	32

Plant Design 817	CAO 817	32

Any of the modules as prescribed for the MEng programmes.

(b) CIVIL ENGINEERING

A limited number of appropriate modules from other departments and from other divisions of Civil Engineering are allowed.

BSc(Hons)(Applied Science)
128 credits from the following:

	Code	**Credits**
Specialisation in **Water Resources (12243030)**		
Basic Applied Hydraulics 786	SHW 786	24
Basic Fundamental Hydraulics 787	SHW 787	24
and *24 credits from the following:*		
Basic Soil Mechanics 785	SGM 785	24
Basic Concrete Structures 792	SIC 792	24
Basic Structural Analysis 790	SIC 790	24
Basic Steel Structures 791	SIC 791	24
Basic Transportation and Traffic Engineering 789	SVV 789	24
Basic Pavements 786	SGM 786	24
Basic Statistical Methods 797	SHC 797	24

and *the remainder of the modules chosen from the modules prescribed for the BEng(Hons)(Water Resource Engineering) programme, as approved by the Head of the Department, and after completion of the appropriate modules from the list above.*

Specialisation in **Geotechnics (12243019)**		
Statistical Methods 791	SHC 791	24
Basic Soil Mechanics 785	SGM 785	24
Geotechnical Design Special 795	SGC 795	24
Soil Mechanics Special 784	SGM 784	24
Geotechnical Laboratory Testing 785	SGS 785	24
In-situ Soil Testing and Monitoring 786	SGS 786	24

Specialisation in **Structures (12243031)**		
Basic Concrete Structures 792	SIC 792	24
Basic Structural Analysis 790	SIC 790	24
Basic Steel Structures 791	SIC 791	24

and *the remainder of the credits chosen from the modules prescribed for the BEng(Hons)(Structural Engineering) programme, as approved by the Head of the Department, and after completion of the appropriate modules from the list above.*

Specialisation in **Transportation Planning (12243028)**		
Basic Transportation and Traffic Engineering 789	SVV 789	24
Basic Pavement Materials and Design 786	SGM 786	24
Basic Statistical Methods 797	SHC 797	24
Transportation Planning 789	SVC 789	24

and *the remainder of the credits chosen from the modules for the BEng(Hons)(Transportation Engineering) programme, as approved by the Head of the Department, and after completion of the appropriate modules from the list above.*

MSc(Applied Science)(Geotechnics)(12253019)
MSc(Applied Science)(Structures)(12253036)
MSc(Applied Science)(Transportation Planning)(12253028)
MSc(Applied Science)(Water Resources)(12253031)

	Code	Credits
Dissertation 890	SST 890	128
or		
MSc(Applied Science)(coursework)		
Specialisation in **Water Resources (12253053)**		
Project 896	SST 896	64
and		
Computer Applications for Civil Engineers 880	SHC 880	32
Advanced Hydraulics 885	SHC 885	32
or		
Specialisation in **Structures (12253054)**		
Project 896	SST 896	64
and		
64 credits from the following:		
Computer Applications for Civil Engineers 880	SHC 880	32
Advanced Structural Analysis 887	SIN 887	32
Advanced Structural Design 886	SIN 886	32
An approved module from the Department of Mechanical and Aeronautical Engineering.		
or		
Specialisation in **Transportation Planning (12253052)**		
Project 896	SST 896	64
and		
Advanced Transportation I 882	SVV 882	32
Computer Applications for Civil Engineers 880	SHC 880	32

(c) ELECTRICAL, ELECTRONIC AND COMPUTER ENGINEERING

MSc(Applied Science)(12253046)

	Code	Credits
Dissertation 891	EER 891	128

(d) ENGINEERING AND TECHNOLOGY MANAGEMENT

BSc(Hons)(Technology Management)(12241072)
128 credits from the following:

	Code	Credits
Core modules		
Engineering Economics 780	IKN 780	16
Technology and Innovation Management 780	ITI 780	16
Project Management 780	IPK 780	16
Systems Engineering 780	ISE 780	16
Operations Management 781	IVV 781	16
Technological Entrepreneurship 780	IEE 780	16
Research Methodology 781	INM 781	16
and		

Electives
(Ad hoc module for students from other departments)

Maintenance Management 780	IMC 780	16
Engineering Logistics 780	IIX 780	16
Quality Management 780	IKK 780	16

MSc(Technology Management)(12251072)
This qualification follows upon the BSc(Hons)(Technology Management)

	Code	**Credits**
Dissertation 895	ITB 895	128

or

MSc(Technology Management)(coursework)(12251076)

Project 898	ISC 898	64
People Management 884	PEM 884	16
Financial Management 831	FBS 831	16
Strategic Management 802	ISM 802	16

and
Elective module

Technology Commercialisation 881	IBM 881	16

or
Module from the MEM/MPM programme (subject to the approval of the head of department)

(e) INDUSTRIAL AND SYSTEMS ENGINEERING

A limited number of appropriate modules from other departments are allowed.

BSc(Hons)(Applied Science)(Industrial Systems)(12243011)

	Code	**Credits**
The following modules are compulsory:		
Basic Statistical Methods 790	SHC 790	16
Research Methodology 781	INM 781	16
Industrial Analysis 780	BAN 780	16
Production Management 781	BPZ 781	16
Business Logistics 780	BLK 780	16

and
a maximum of 48 credits elected from the BEng(Hons) programme.

MSc(Applied Science)(Industrial Systems)(12253011)

	Code	**Credits**
Dissertation 891	BIR 891	128

(f) MATERIALS SCIENCE AND METALLURGICAL ENGINEERING

A limited number of appropriate postgraduate modules from other departments are allowed.

BSc(Hons)(Applied Science)(Metallurgy)(12243022)

	Code	Credits
At least 32 credits from the following:		
Basic Hydrometallurgy 701	NHM 701	32
Basic Physical Metallurgy 701	NFM 701	32
Basic Pyrometallurgy 701	NPM 701	32
and		
a maximum of 32 credits from the following: (optional)		
Basic Statistical Methods 790	SHC 790	16
Research Methodology 781	INM 781	16
Project Management 780	IPK 780	16
***or** (optional)*		
Project 411	NSC 411	8
Project 421	NSC 421	44
and		

the balance of the credits(for a total of 128) chosen from the modules for the BEng(Hons) programme, as approved by the Head of the Department and after completion of the appropriate 701 modules.

MSc(Applied Science)(Metallurgy)(12253022)

	Code	Credits
Dissertation 891	NIN 891	128

(g) MECHANICAL AND AERONAUTICAL ENGINEERING

A limited number of appropriate modules from other departments are allowed.

BSc(Hons)(Applied Science(Mechanics)(12243021)

	Code	Credits
Structural Mechanics 732	MSY 732	32
Thermoflow 732	MTV 732	32
and		

at least 64 credits chosen from the modules as prescribed for the BEng(Hons) programme, as approved by the Head of the Department.

MSc(Applied Science)(Mechanics)(12253021)

	Code	Credits
Dissertation 891	MIR 891	128

(h) MINING ENGINEERING

A limited number of appropriate modules from other departments are allowed.

BSc(Hons)(Applied Science)(Mining Environmental Control)(12243023)
or
BSc(Hons)(Applied Science)(Mine Strata Control)(12243024)

	Code	Credits
At least 64 credits from the following:		
Basic Mine Environment Engineering 700	PKB 701	32
Basic Rock Mechanics 700	PSZ 703	32

Basic Mining Methods 700	PMY 701	32

and

at least 64 credits chosen from the modules as prescribed for the BEng(Hons) programme (excluding Financial Mine Evaluation PFZ 780), as approved by the Head of Department.

MSc(Applied Science)(Mining Environmental Control)(12253023)
or
MSc(Applied Science)(Mine Strata Control)(12253024)

	Code	**Credits**
Dissertation 891	PYI 891	128

DOCTORAL DEGREES

DOCTOR OF PHILOSOPHY (ENGINEERING) [PhD(Engineering)]

Eng. 25

Also consult the General Regulations G.45 to G.55 and G.57 to G.62.

(a) Subject to the stipulations of Regulations G.45 and G.62, 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 the 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.

DOCTOR OF PHILOSOPHY (PhD)

Eng. 26

Also consult the General Regulations G.45 to G.55 and G.57 to G.62.

(a) Subject to the stipulations of Regulations G.45 and G.62 a master's degree is required for admission to studies for a PhD.

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

(c) Unless the 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 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 sub-stantial contribution to the knowledge of Engineering Science and/or Practice.

DOCTOR OF ENGINEERING (DEng) (Code 12260001)

Eng. 27
The degree DEng is awarded on the basis of publications. Subject to General Regulation G.56, the following applies:

1. **Admission**
   The degree is conferred on a candidate who can demonstrate that he/she enjoys international recognition in her/his field of expertise by virtue of the quality and impact of the publications that have been produced.

2. **Application**
   (a) A candidate must apply in writing to be considered for the degree.
   (b) Should a candidate wish to graduate at a particular ceremony, an application must be submitted before the closing date of the various graduation ceremonies, which is announced annually.
   (c) The application must be accompanied by
      (i) four sets of copies of the publications by virtue of which application is made;
      (ii) a declaration made before a Commissioner of Oaths in which the candidate testifies that the publication/s submitted for the doctoral degree
         – has/have not previously been submitted to this or any other tertiary institution for such a doctoral degree;
         – is/are his or her own work, and with regard to such publication/s of which he or she is co-author, that his or her personal contribution to those works is clearly stated;
         – take(s) place with due recognition given to the author's copyright in accordance with the case.
      (iii) a summary of not more than 500 words that indicates the contribution that the work has made to the discipline.

3. **Registration**
   A candidate must register in the manner determined by the University and pay the prescribed registration fee.

4. **Evaluation of the publications**

(a) The dean appoints a committee, chaired by the chairperson of the Research Committee and of which the head of the department concerned is a member, to make a recommendation to the faculty board as to whether the works have sufficient substance to be submitted for examination in terms of G.56.5(b).

(b) If the faculty board accepts the recommendation, the Postgraduate Committee appoints an examination panel for a particular candidate, subject to approval by the dean.

(c) The head of the department concerned compiles a list of names of potential examiners both inside and outside of South Africa from which the Postgraduate Committee chooses at least three external examiners from outside the University, all of whom must be recognised internationally as having made significant contributions in the field of study. Normally, at least two of these examiners would be from outside South Africa.

(d) No examiner should have any interest in the candidate or in any way be involved in the research that the candidate has done previously.

(e) External examiners must be from different institutions.

(f) As soon as a potential examiner has accepted his/her appointment as examiner, he/she is supplied with a formal letter of appointment as well as documentation on the policy of the University concerning examinations. Examiners must sign an acceptance form that is to be returned to the Head: Student Administration.

(g) A candidate passes if all the members of the examination panel accept the publications for the purposes of conferring the doctoral degree, and on condition that if all but one of the examiners accept the work, the dean, after consultation with the Postgraduate Committee, may appoint a knowledgeable and esteemed academic of stature from outside the University as additional examiner. If the additional examiner accepts the publications, the candidate passes. If such an examiner also rejects the publications, the doctorate is not conferred.

(h) A candidate is only considered once for a doctoral degree based on publications.

(i) The degree is not conferred with distinction.

(j) After a decision on whether the degree is to be conferred or not, has been reached, as indicated in (g) above, the Head: Student Administration has to

  (i) address a letter to the examiners to thank them for their participation in the examination and for their recommendations;

  (ii) inform the examiners of the final result and indicate to them what their further involvement, if any, will be in the remainder of the process;

  (iii) inform the candidate and the head of the department of the final result.

SUMMARY OF SYLLABI: BACHELOR OF ENGINEERING

Explanation of the codes appearing next to the name of each module:

Example: MSD 210 **DYNAMICS 210, (16), 3-2-0, (B2, E2, M2, N2, P2, Z2)**

(MSD 210): Module code
MSD: A letter code of which the first letter identifies the department/division in the School of Engineering which is responsible for the presentation of the module, as indicated in the table below:

Letter	Department
B	Industrial and Systems Engineering
C	Chemical Engineering
E	Electrical, Electronic and Computer Engineering
I	Engineering and Technology Management
M	Mechanical and Aeronautical Engineering
N	Materials Science and Metallurgical Engineering
P	Mining Engineering
S	Civil Engineering

210: Numerical code

First digit:	The level of the module (year of study in which the module is normally presented)
Second digit:	1, 5 or 7 = First semester; 2, 6 or 8 = Second semester
Third digit:	Module number

(16): SAQA credit value of the module

3-2-0: Division of the contact time during presentation of the module

First digit:	Number of lectures per week (50 minutes each)
Second digit:	Number of tutorial classes per week (50 minutes each)
Third digit:	Number of practical periods per week (45 minutes each)

(E2, M2, N2, P2, Z2): Field of study and year of study in which the module is offered.

Symbol	Field of Study
B	Industrial Engineering
C	Chemical Engineering
E	Electrical Engineering
R	Computer Engineering
Z	Electronic Engineering
M	Mechanical Engineering
N	Metallurgical Engineering
P	Mining Engineering
S	Civil Engineering

Summary of the syllabi of the undergraduate modules, alphabetically, in accordance with the module codes:

1. First and Second Year of Study (New Programmes)

BES 220 **ENGINEERING STATISTICS 220, (8), 2-1-0, (B2, C2, E2, N2, P2, R2, S2, M2, Z2)**
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, regression analysis and an introduction to experimental design.

BPZ 220 **PRODUCTIVITY 220, (16), 3-1-2, (B2)**
Qualifying and quantifying productivity: Efficiency, effectiveness, utilisation, profitability and competitiveness. Method study: Critical examination and process flow charts and diagrams. Work measurement: Time study and activity sampling. Organisational behaviour: Motivation, incentive schemes, group forming, work teams, job design and change management. Ergonomics.

CHM 171 **GENERAL CHEMISTRY 171, (16), 4-2-2, (B1, C1, M1)**
CHM 172 **GENERAL CHEMISTRY 172, (16), 4-2-2, (E1, N1, P1, S1, Z1)**
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, (16), 4-2-2, (C1)**
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, (16), 3-1-3, (C2)**
Organic chemistry. Chemical properties of organic (including aromatic) compounds. Functional group transformation and synthesis. Introduction to polymers.
Physical chemistry. Colloid chemistry. Surface chemistry and processes at solid surfaces. PVT properties of real gases.

CHM 226 **CHEMISTRY 226, (8), 2-0-3, (C2)**
Instrumental analytical chemistry. The science, technology and application of selected instrumental techniques from the three broad areas of 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 and liquid chromatography as well as combinations of analytical techniques

CIL 111 **COMPUTER LITERACY 111, (4), 2-0-2, (B1, C1, E1, M1, N1, P1, R1, S1, Z1)**
Computing concepts. Windows 2003; Internet and World Wide Web. What will word processing do for me? Editing and formatting. Enhancing a document and the web and other resources. Advanced features: Outlines, Styles and selections and Tables. Introduction to PowerPoint. Presentations made easy. Slide show tools. The web and Slide Masters. Introduction to MS Excel: What is a spreadsheet? The web and business applications. Spreadsheets in decision making: What if? Graphs and charts: Delivering a message. Introduction to MS Access: What is a database? Tables and Forms: Designs, Properties, Views and Wizards. Information from the database: Reports and queries. (An exemption examination may be written in the first week of semester 1.)

CIL 121 **INFORMATION LITERACY 121, (4), 2-0-2, (B1, C1, E1, M1, N1, P1, R1, S1, Z1)**
Why computers matter to you, Networking. Information resources (including the Department of Library Services). Quality of information. Ethics, plagiarism and copy right. Searching the Internet. Information Seeking Strategies. Location and access. Specific search environments (including all electronic databases and journals in the Department of Library Services applicable to the relevant faculties). Referencing techniques. Use synthesis and evaluation of information. New trends. Content specific to University of Pretoria. No exemption examination.

CIR 113 **CHEMICAL ENGINEERING 113, (8), 2-2-0, (C1)**
Dimensions, units and their conversion. The mol unit, density, concentration. Specific volume, bulk density, density of ideal mixtures. Temperatures and conversions. Pressure, absolute and gauge. Expression of concentration. Empirical formulae. Introduction to material balances: strategy for solving problems. Material balances without chemical reaction. Combinations of equipment.

CIR 123 **CHEMICAL ENGINEERING 123, (8), 2-2-0, (C1)**
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, Nm^3. Material balances where gases are involved. Fuels and combustion: coal analysis, combustion calculations.

CIR 211 **CHEMICAL ENGINEERING 211, (8), 2-2-0, (C2)**
Vapour pressure, phase changes, equilibrium. Vapour/gas equilibrium; Henry's law. Enthalpy and enthalpy balances. Heat of reaction. Data and data sources, steam tables. Enthalpy and combustion; flame temperature. Heats of solution and mixing. Miscible and immiscible liquid mixtures; dew point, bubble point. Simultaneous mass and enthalpy balances.

COS 121 **SOFTWARE MODELING 121, (16), 4-0-1 (R2)**
The module will introduce the concepts of model-driven analysis and design as a mechanism to develop and evaluate complex software systems. Systems will be decomposed into known entities, such as design patterns, classes, relationships, execution loops and process flow, in order to model the semantic aspects of the system in terms of structure and behaviour. An appropriate tool will be used to support the software modelling. The role of the software model in the enterprise will be highlighted.
Students who successfully complete this module will be able to conceptualise and analyse problems and abstract a solution.

COS 131 **INTRODUCTION TO PROGRAMMING 131, (16), 4-0-1, (R1, E2, Z2)**
The aim of this module is to acquire a sound knowledge of basic computer programming concepts and an introductory knowledge of data structures. The theory of these concepts, as well as design methodologies, will be investigated. Understanding rather than memorising is emphasized in order to stimulate creative thinking and the development of innovative skills amongst students in the field of computer programming. The C programming language is used to implement these concepts. At the end of the module a short introduction to object-oriented programming using C++ will be given.
After completing this module, a student should be able to design and write structured, efficient programs using the C programming language, be familiar with the basic data structures, pointers and file processing, and have an introductory knowledge of advanced data structures and object orientation.

COS 140 **NETCENTRIC COMPUTER SYSTEMS 140, (16), 4-0-1 (R1)**
This module introduces the principles of netcentric computing that can be applied to the WWW and internet as well as to distributed applications. The main focus is on the concepts of client and server side programming, web-based applications, port and socket interaction, writing programs that require remote function calls, and achieving database connectivity using the appropriate technology. The supporting technologies of mark-up languages and scripting languages are also studied. It will also test the ability of a student to use, integrate and maintain the necessary software and hardware required to illustrate the concepts specified.

COS 212 **DATASTRUCTURES AND ALGORITHMS, (16), 4-0-1 (R2)**
Die primary objective of this module is to introduce students to the classic data structures and algorithms found in computer programs. Data abstraction is an important concept in producing correct and re-usable software. In this module it is shown how abstract data types can be designed for the classic data structures, i.e. stacks, queues, lists, trees and graphs. Variations that can be made to the implementation of the structures without changing their interfaces are discussed as well as how to choose the appropriate version for efficiency. Classic algorithms for sorting, searching and traversing are investigated and their efficiency assessed. Recursion is also dealt with and some of the algorithms are implemented recursively. The meaning of algorithmic complexity is introduced to gain an appreciation of the limits of computing through examples of problems that cannot be solved in reasonable time.

COS 222 **OPERATING SYSTEMS 222, (16), 4-0-1, (R2)**
Fundamental concepts of modern operating systems in terms of their structure and the mechanisms they use are studied in this module. Real Time, Multimedia and Multiple Processor Systems are defined and analysed. This module also deals with modern design issues of process management, deadlock, memory management, input/output management, file systems and security.

CTD 223 **THERMODYNAMICS 223, (16), 4-2-0, (C2)**
Simple applications of the first and second laws of thermodynamics. The concepts of work, heat, enthalpy and entropy. Equations of state for gases and gas mixtures, the calculation of internal energy, enthalpy and entropy using the equations of state. Simple heat engine cycles. Refrigeration and gas liquefaction. Process efficiency by means of energy. Introduction to equilibrium composition principles in multiphase non-reacting systems with due allowance for non-ideality in the phases and the mixtures.

EBN 111 **ELECTRICITY AND ELECTRONICS 111, (16), 4-2-2, (E1, N1, P1, R1, S1, Z1)**
EBN 122 **ELECTRICITY AND ELECTRONICS 122, (16), 4-2-2, (B1, C1, M1)**
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.

EIR 211 **ELECTRICAL ENGINEERING 211, (16), 3-1-1, (E2, R2, Z2)**
EIR 221 **ELECTRICAL ENGINEERING 221, (16), 3-1-1, (C2, N2, M3)**
Circuit principles: Sinusoidal voltages and currents, RMS-values, phasors, complex impedance, power, three-phase circuits, transients. Digital systems and computer principles: logic circuits, computer architecture, memory, microprocessors. Electronics: diodes – ideal, rectifier, zener, photo, LED; amplifier circuits, practical operational amplifiers, limiters, rectifiers, voltage regulators, pn-junction theory: BJT and FET, transistor amplifiers. Electricity: transformers; electrical machines – (DC and AC), equivalent circuits, speed control; power generation, small-signal analysis, and distribution – electrical energy sources, transmission and protection, power and energy metering and tariffs, power factor correction, lightning and surges. Lighting.

EIW 121/221/320 **INFORMATION TECHNOLOGY PRACTICE 121/221/320, (8/8/8), (R1, R2, R3)**
These modules are offered at the end of the first, second, third and fourth year of study respectively. The duration is at least two weeks during which the students receive practical training in computers and computer networks. The modules may for practical reasons be offered in a different time slot (e.g. at the beginning of the next year of study).

ELI 220 **LINEAR SYSTEMS 220, (16), 3-1-1, (E2, R2, Z2)**
Frequency domain analysis of linear time-invariant systems. Laplace, Fourier and z-transforms applied to periodic, aperiodic and sampled signals; exponential and trigonometric Fourier series. Nyquist sampling theorem, transfer functions, poles and zeros, bandwidth and rise time, frequency response, impulse response, Bode diagrams, natural frequency, natural and forced response. Instability and oscillations. Computer simulation.

EMR 100 **MEASUREMENT TECHNIQUES AND COMPUTER MODELLING 100, (4), (E1, R1, Z1)**
This module is presented at the end of the first semester. It lasts for one week. During this time Electrical, Electronic and Computer Engineering students receive training in Instrumentation and Measurement Techniques in the Department's electronics laboratories, as well as in the use of computer simulation programs (such as Matlab) in the computer laboratories.

EOS 284 **COMPUTER ARCHITECTURE 284, (16), 3-0-1, (R1)**
The aim of this module is to gain a deeper understanding of computers by studying their underlying components. The CPU is studied in great detail, covering design decisions such as CISC/RISC architectures, paging and pipelining. Cache, memory and bus architectures

will also be scrutinized. IO architectures will be covered (i.e. polling vs. interrupt driven or DMA). Topics such as parallel processing (SIMD) are also touched. A brief review of number systems, combinatorial circuits, and sequential circuits (latches, counters, etc.). To illustrate many of the concepts in practice, the practicals will cover an assembly language. This will cover topics like interrupts, IO and video memory.

EPW 200 **PRACTICAL WIRING 200, (4), (E2)**
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.

ERS 220 **DIGITAL SYSTEMS 220, (16), 3-1-1, (E2, R2, Z2)**
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.

FSK 116 **PHYSICS 116, (16), 4-2-2, (B1, C1, M1)**
FSK 176 **PHYSICS 176, (16), 4-2-2, (E1, N1, P1, R1, S1, Z1)**
Introductory mathematics: Symbols, exponents, logarithms, angles in degrees, radial measure, goniometry, differentiation, and integration. Motion along a straight line: position and displacement, acceleration. Vectors: adding vectors, components, multyplying vectors. Motion in two and three dimensions: projectile motion, circular motion. Force and motion: Newton's Law, force, friction. Kinetic energy and work: work, power. Potential energy: Centre of mass, linear momentum. Collisions: impulse and linear momentum, elastic collisions, inelastic collisions. Rotation: kinetic energy of rotation, torque. Oscillations and waves: Simple harmonic motion, types of waves, wavelength and frequency, interference of waves, standing waves, the Doppler effect. Temperature, heat and the first law of thermodynamics.

GMI 210 **MINERALOGY 210, (16), 4-2-0, (N2)**
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.

JCP 203 **COMMUNITY-BASED PROJECT 203 1-0-0, (8), (B2, C2, E2, M2, N2, P2, R2, Z2, S4)**
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 on the module website.

JNV 100 **INNOVATION 100, (4 + 4), 2-0-0, (all first-year students who failed the Academic Literacy Test)**
The development of basic language proficiency in the context of and by means of examples from the engineering and technology environment.

JPO 110 **PROFESSIONAL ORIENTATION 110, (8), 0-4-4, (Five-year programme)**
JPO 120 **PROFESSIONAL ORIENTATION 120, (8), 0-4-4, (Five-year programme)**
Academic support and development within the wider engineering context. Technological skills: Skills of observation (analyse and interpret information), planning, designing, component estimates, problem-solving and computer skills (word processing, computations, graphics, Internet). Communication skills: Listen, read, write and presentation. Social and personal skills: Goal-setting and time management, stress management, creativity, career planning, study strategies, decision making, budgeting, ethics and values. Fundamental mathematical concepts.

JSQ 216 **COMMUNICATION SKILLS 216, (8), 1-2-0, (B2, C2, E2, M2, N2, P2, R2, S2, Z2)** (only presented in English)
The module focuses on the development of academic and professional writing abilities in the field of engineering, with special emphasis on the technical report. Students first explore the various modes of technical and academic writing (e.g. description, process, explanation, cause/effect, comparison/contrast, argumentation), including the language features associated with each mode. Thereafter they independently plan, write and revise an authentic engineering report.

MGC 110 **GRAPHICAL COMMUNICATION 110, (16), 3-3-0, (B1, C1, E1, M1, N1, P1, S1, Z1)**
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.

MOW 217 **MANUFACTURING AND DESIGN 217, (16), 3-4-0, (M2, B2)**
Introduction to design, economic implication, choice of materials, systems and safety factors, specifications, life cycle concepts. Friction, wear, thin film lubrication, plain bearings - theory and mounting, Rolling elements bearings, mounting of bearings, seals and applications. Surface finish, machining symbols, tolerances, limits and fits, Fastening methods. Shaft couplings, cam and crank shafts. Solid modelling. Introduction to strength of materials. Normal and shear stress. Shear force and bending moment diagrams. Transformation of stress/mohr circle. Hookes law and Poisson's ratio. Failure theories, Torsion and bending of beams. Buckling.

MOW 227 **MACHINE DESIGN 227, (16), 3-4-0, (M2)**
Machine elements to be covered includes: Clutches and brakes, gear drives, chain drives, belt drives, governors, screw drives, flywheels, hooke joints, mechanisms. The theory of machines as well as design aspects will be covered. The design of castings. The following strength of material aspects to be covered in the module: Stress concentrations. Static calculation of shafts. Fatigue. Bolted connections, Weld design.

MPR 212 **PROGRAMMING AND DATA PROCESSING 212, (16), 3-0-2, (B2, C2, M2, N2, P2, (S3 from 2010))**
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.

MSD 210 **DYNAMICS 210, (16), 3-2-0, (B2, E2, M2, N2, P2, S3, Z2)**
Kinetics of systems of particles, Newton's 2nd law generalised for a system of particles, rate of change of momentum and angular momentum relations, work-energy relations, conservation laws, steady mass flow. Plane kinematics of rigid bodies, rotation, translation, general 2D motion, relative motion analysis. Moments and products of inertia. Plane kinetics of rigid bodies, equations of motion, rotation, translation, general 2D motion, work-energy relations. Vibration and time response.

MTX 221 **THERMODYNAMICS 221, (16), 3-1-1, (B2, C2, M2, P2)**
Application overview. Concepts: system, control volume, property, state, process, cycles, mass, volume, density, pressure, pure substances, property tables, ideal gases. Work and heat. Internal energy, enthalpy, specific heat capacity. First Law of Thermodynamics for system and control volume. Conservation of mass. Processes: Adiabatic, isentropic, compressible and incompressible gases. Second Law of Thermodynamics for system and control volume. Entropy and enthalpy. Third Law of Thermodynamics. Introduction to vapour power, cooling and gas cycles. Experimental techniques in thermodynamics.

NMC 113 **MATERIALS SCIENCE 111, (16), 4-1-1, (E1, N1, P1, S1, Z1)**
NMC 123 **MATERIALS SCIENCE 122, (16), 4-1-1, (B1, M1)**
Introduction to materials: the family of materials, atomic structure and types of bonding, crystal types and space arrangement of atoms, directions and planes in crystals, defects in crystals, diffusion in solids. Mechanical properties of materials: stress and strain, mechanical testing (strength, ductility, hardness, toughness, fatigue, creep), plastic deformation, solid-solution hardening, recrystallisation.
Polymeric materials: polymerisation and industrial methods, types of polymeric materials and their properties. Corrosion of metals: mechanisms and types of corrosion, corrosion rates, corrosion control. The heat treatment of steel: Fe-C phase diagram, equilibrium cooling, hardening and tempering of steel, stainless steel. Composite materials: Introduction, fibre reinforced polymeric composites, concrete, asphalt, wood.

NMC 223 **MATERIALS SCIENCE 223, (16), 4-0-2, (N2)**
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).

NPT 220 **PROCESS THERMODYNAMICS 220, (16), 4-2-0, (N2)**
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.

PPY 220 **EXPERIENTIAL TRAINING 220, (16), (P2)**
The mining industry requires students to become exposed to mining by working on mines during the December recess period at the end of the first 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 second academic year.

PWP 120 **WORKSHOP PRACTICE 120, (8), (P1)**
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.

SBZ 221 **CIVIL ENGINEERING MEASUREMENT TECHNIQUES 221, (8), 2-1-1, (S2)**
Measurement instruments and measurement techniques used in engineering applications. Theory of the Wheatstone bridge and the application of strain gauges to measurement instruments. Accuracy, precision, resolution, hysteresis and linearity. Load cells, pressure sensors, displacement transducers, stress cells and inclinometers.

SGM 210 **GEOMATERIALS AND PROCESSES 210, (16), 4-0-3, (S2)**
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, (16), 2-1-2, (S2)**
Geological origin. Soil tests and classification systems. Compaction, stabilisation. Bitumen and tar. Polymers. Introduction to pavements. Overview of road building materials. Pavement design principles and methods.

SIN 223 **STRUCTURAL ANALYSIS 223, (16), 3-1-2, (S2)**
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).

SNV 111 **INNOVATION 111, (4), 2-0-0, (B1, C1, E1, M1, N1, P1, R1, S1, Z1)**
Technological innovation is introduced via the basic concepts of creativity, invention, thinking patterns, paradigms and barriers to creativity and innovation. This semester focuses on the theory behind these basic concepts. The four quadrant whole brain theory of Ned Herrmann is used as a scientific basis for the exploration of this subject area. A strong emphasis is placed on co-operative learning with support given to students regarding whole

brain thinking preferences and whole brain groups formation as well as demographic, gender and discipline diversity in such groups. A five-step creative problem solving process is used and linked to this four quadrant whole brain theory to help students gain insight into the requirements for different thinking preferences during the various stages of innovation and creativity.

SNV 121 **INNOVATION 121, (4), 0-0-4, (B1, C1, E1, M1, N1, P1, R1, S1, Z1)**
The theory of creativity, invention and innovation is put to practice in this semester. Students are grouped into multidisciplinary, multi-gender and multicultural groups to work on an innovation based on prescribed problem themes. Basic engineering skills, including observation and interpretation of information, problem-solving skills (problem identification, idea generation, idea evaluation, implementation, assessment) are practiced during the process. A strong emphasis is placed on effective scientific and engineering communication skills (reading, interpretation of visual presentations, writing, listening and presenting in oral or printed format). Management of engineering assignments (planning, time management and co-operation, and control) are practiced in group assignments to foster creativity and innovation.

SUR 210 **SURVEYING 210, (16), 3-0-4, (S2)**
SUR 220 **SURVEYING 220, (16), 3-0-4, (P2)**
Adjustment and use of following instruments: Plane table, level, compass and theodolite. Elementary site surveying and levelling, tachometry. Definition of survey. Co-ordinate systems and bearing. Connections and polars. Methods of determining points. Elevation. Tachometry.

SWK 122 **MECHANICS 122, (16), 4-2-0, (B1, C1, E1, M1, N1, P1, S1, Z1)**
Equivalent force systems, resultants. Newton's laws, units. Forces acting on particles. Rigid bodies: principle of transmissibility, resultant of parallel forces. Vector moments and scalar moments. Relationship between scalar and vector moments. Couples. Equivalent force systems on rigid bodies. Resultants of forces on rigid bodies. Equilibrium in two and three dimensions. Hooke's Law. Trusses and frameworks. Centroids and second moments of area. Beams: distributed forces, shear force, bending moment, method of sections, relationship between load, shear force and bending moment.

SWK 210 **STRENGTH OF MATERIALS 210, (16), 4-2-0, (C2, P2, S2)**
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 prismatic beams. Strain transformation: Plane strain transformation, principle strains, maximum values, strain gauges and rosettes and the relationship between E, G and υ. Design of beams from section characteristics. Deflection of beams: The elastic curve, integration method, Macaulay's method and superposition.

SWP 121 **WORKSHOP PRACTICE 121, (6), (S1)**
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 and structural steel. A satisfactory report must be submitted within two weeks after the commencement of lectures of the second year of study.

WST 111 **MATHEMATICAL STATISTICS 111, (16), 4-0-1, (R1)**
Introductory statistical concepts: Sampling and descriptive methods, elementary probability theory and elementary distribution theory. Special statistical distributions. Statistical inference: Point and interval estimation. Identification, use, evaluation and interpretation of statistical computer packages and statistical techniques.

WTW 158 **CALCULUS 158, (16), 4-4-0, (B1, C1, E1, M1, N1, P1, R1, S1, Z1)**
Vector algebra with applications to geometry. 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 techniques. This module is designed for first-year engineering students.

WTW 161 **LINEAR ALGEBRA 161, (8), 2-2-0, (B1, C1, E1, M1, N1, P1, R1, S1, Z1)**
Vector algebra with applications, matrix algebra, systems of linear equations, the vector space R^n, bases, determinants. Mathematical induction. Complex numbers and factorisation of polynomials. Conic sections. This module is designed for first-year engineering students.

WTW 168 **CALCULUS 168, (8), 2-2-0, (B1, C1, E1, M1, N1, P1, R1, S1, Z1)**
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. This module is designed for first-year engineering students.

WTW 238 **MATHEMATICS, (16), 4-2-0, (B2, C2, E2, M2, N2, P2, R2, S2, Z2)**
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, (8), 2-2-0, (B2, C2, E2, M2, N2, P2, R2, S2, Z2)**
Theory and solution methods for linear differential equations as well as for systems of linear differential equations. Theory and solution methods for first order non-linear differential equations. The Laplace transform with application to differential equations. Application of differential equations to modelling problems.

WTW 258 **CALCULUS 258, (8), 2-2-0, (B2, C2, E2, M2, N2, P2, R2, S2, Z2)**
Calculus of multivariable functions, directional derivatives. Extrema. Multiple integrals, polar, cylindrical and spherical coordinates. Line integrals and the theorem of Green. Surface integrals and the theorems of Gauss and Stokes.

WTW 263 **NUMERICAL METHODS 263, (8), 2-2-0, (B2, C2, E2, M2, N2, P2, R2, S2, Z2)**
Solution of non-linear equations. Direct and iterative methods of solving systems of equations (linear and non-linear). Solution of differential equations and systems of differential equations. Numerical integration.

WWP 121 **WORKSHOP PRACTICE 121, (6), (B1, C1, M1, N1)**
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.

2. Third and Fourth Year of Study (Old Programmes)

(ABV 320) **LABOUR RELATIONS 320, (8), 3-0-0, (B4)**
A systems approach to labour relations. The influence of different variables on the labour relations role players. The management and maintenance of balanced labour relations within an enterprise through representation, communication, grievances and disciplinary procedures. The relation between labour relations management and people power management. The handling of disputes and the keeping of industrial peace.

(BCC 410) **COMPUTER CONTROL 410, (16), 2-1-2, (B4)**
Principles of digital control, digital mathematics, microcomputer control, programming of micro controllers, implementing ASSEMBLER programmes, stepmotor control, control through the parallel port, introduction to robotics and the kinematics of robots.

(BEN 420) **ELECTIVE 420, (16), (B4)**
An elective module chosen from an approved shortlist.

(BER 310) **BUSINESS LAW 310, (16), 4-0-0, (B3)**
(Presented by the Department of Mercantile Law)
Introduction to law. General principles of contract law. Specific contracts: purchase contracts, job contracting. Representative law. General aspects of business law. Dispute resolution – mediation and arbitration.

(BFB 310) **FACILITIES PLANNING 310, (8), 2-1-0, (B3)**
Facilities planning process. Facilities location. Product development. Process planning, requirements and selection of equipment and labour. Production systems – process choice, group technology, manufacturing cells, flexible manufacturing and automation. Assembly line balancing, yield and cost models and machine coupling. Personnel facilities. Manufacturing support activity requirements. Materials handling and control – principles, equipment, system design, unit loads, flow lines, grouping and packaging. Storage and warehousing operations. Space requirements and layout planning. Visual management. Industry visits and facilities planning project.

(BGC 410) **QUALITY ASSURANCE 410, (16), 3-1-0, (B4)**
Introduction to quality and quality management systems. Statistical process control. Acceptance control.

(BID 320) **INFORMATION SYSTEMS DESIGN 320, (16), 3-1-2, (B3)**
System requirement analysis, structural analysis, system specification, structured designing of systems, data flow charts, process flow charts, database design and normalization, software design, the test plan, the control plan, implementation.

(BIE 310) **ENGINEERING ECONOMICS 310, (8), 2-1-0, (S2, B3, M3, N3, P3)**
(BIE 320) **ENGINEERING ECONOMICS 320, (8), 2-1-0, (E4, R4, Z4)**
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, economic value added {EVA}). Decision making among alternatives (useful lives equal to study period, useful lives different among alternatives, mutually exclusive alternatives in terms of combinations of proposals). The influence of inflation on engineering economic calculations. Decision making among alternatives on an after-tax basis. Replacement analysis (the economic life of an asset, retirement without replacement). Evaluating projects with the Benefit/Cost Ratio method.

(BLK 320) **INDUSTRIAL LOGISTICS 320, (16), 4-2-0, (B3)**
Role of logistics in the economy and organisation. Customer service. Forecasting. Logistics information systems and electronic information flow. Inventory management. Managing materials flow. Distribution channels. Transportation. Warehousing. Packaging. Strategic purchasing. Global logistics. Organising and controlling logistics. Supply chain management. Implementing logistics strategy.

(BOB 310) **OPERATIONS MANAGEMENT 310, (16), 4-2-0, (B3)**
Introduction to operations management, operations strategy and competitiveness. World Class and agile manufacturing. Operations planning in the service industries. The manufacturing management environment. Manufacturing planning and control systems. Sales and operations planning. Capacity planning and control. Demand management. Master production scheduling. Materials requirements planning (MRP). Distribution requirements planning. Just-in-time (JIT) manufacturing. Synchronous manufacturing (Theory of Constraints). Comparing MRP, JIT and TOC. Shop-floor scheduling and control. Integration and implementation of manufacturing planning and control systems. Enterprise Resource Planning (ERP) systems. Business process transformation.

(BON 410) **OPERATIONS RESEARCH 410, (16), 3-1-0, (B4)**
Review of basic probability, Markov chain models, Markov decision models. Queueing 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 311) **OPERATIONS RESEARCH 311, (16), 4-2-0, (B3)**
Introduction to Operations Research. Introduction to linear programming, linear algebra, classical linear programming applications, solution algorithms, sensitivity analysis, duality. Computer programming packages.

(BOZ 321) **OPERATIONS RESEARCH 321, (16), 4-2-0, (B3)**
Integer programming. Special linear programming applications, shipment problems, allocation problems, transportation problems. Goal programming. Dynamic programming. Network models. Computer programming packages.

(BPE 451) **PROFESSIONAL ETHICS AND PRACTICE 451, (8), 1-2-0, (B4, E4, M4, N4, P4, R4, S4, Z4)**
The module has a twofold goal: (i) to make students aware of the moral dimension of the enigineering profession, and (ii) to enhance the development of their ethical skills in dealing with moral issues in this practice. Attention is given to important concepts and approaches in professional ethics and to suitable methods in moral problem solving. A number of major issues engineers are confronted with are also dealt with: What does it take to be a responsible and honest engineer? To what extent does the engineer have the obligation to avoid risks and promote safety? How should engineers solve the tension

between their professional obligations and expectations employers have? How far does the responsibility of engineers for the natural environment go? How can engineers act morally responsibly in an international context? During discussion classes a number of case studies illustrating these moral issues are thoroughly analysed.

(BPJ 410) **PROJECT 410, (8), 0-1-0, (B4)**
Choice of a project topic. Appointment of a project leader. Project planning. Literature study, analysis, creation of alternatives and narrowing of choice. Writing of first semester report and presentation of project.

(BPJ 420) **PROJECT 420, (32), 0-1-0, (B4)**
Detailed solution of chosen alternative. Writing of final project report and presentation of project.

(BPY 310) **PRACTICAL TRAINING 310, (16), (B3)**
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 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.

(BPY 410) **PRACTICAL TRAINING 410, (16), (B4)**
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 421) **BUSINESS ENGINEERING 421, (16), 4-2-0, (B4)**
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.

(BRV 320) **COMPUTER-AIDED MANUFACTURING 320, (8), 2-0-1, (B3)**
Basic manual programming of CNC machines. Advanced three-dimensional surface programming. Parameter programming. Post-processors for CNC machines. High-speed machining.

(BSR 410) **MANAGEMENT ACCOUNTING 410, (16), 6-0-0, (B4)**
The work of management and the need for managerial accounting information. The changing business environment. Cost terms, concepts, and classification. Job order costing. Process costing. Activity-based costing and quality management. Cost-volume-profit relations. Variable and fixed costing. Budgeting and control. Standard costs and flexible budgets. Segment reporting and decentralisation. Relevant costs for decision-making. Allocations of service departments cost to operating departments.

(BUY 321) **SIMULATION MODELLING 321, (16), 4-2-0, (B3)**
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.

(BVS 310) **MANUFACTURING SYSTEMS 310, (16), 3-3-1, (B3)**
Evaluation of product designs for manufacturability, choice of material, generic development methodology, design of manufacturing processes, process planning, specification of production facilities.

(CBI 310) **BIOCHEMICAL ENGINEERING 310, (8), 2-0-1, (C3)**
Characterization of biological material. Taxonomy, chemical composition, growth requirements and reproduction. Metabolism and reproduction. Metabolism and product formation. Growth kinetics, batch and continuous cultivation. Reactor design, operation and product recovery. Case studies.

(CHO 321) **HEAT TRANSFER 321, (8), 2-2-0, (C3, N3)**
Steady and unsteady state conduction in one to three dimensions. Temperature distributions. Convective heat transfer. Application of boundary layer theory. Determination of film coefficients. Design of heat transfer equipment. Boiling and evaporator calculations. Radiant heat transfer. Process integration.

(CIR 412) **CHEMICAL ENGINEERING 412, (16), 4-2-0, (C4)**
Humidification and dehumidification of air. Water cooling, drying, crystallisation, ion exchange, particle technology, particle movement in a fluid, sedimentation. Hydrocyclones, flotation, filtration. Centrifuges. Fluidized bed technology. Mixing. Comminution. Pneumatic transport.

(CKN 320) **KINETICS 320, (12), 2-2-0, (C3)**
Reaction kinetics: Reaction order, rates and mechanisms. Langmuir-Hinshelwood kinetics. Chemical equilibrium, conversion, temperature and concentration dependency of reaction rates. Ideal reactor models.

(CLB 321) **LABORATORY 321, (16), 0-0-8, (C3)**
Experimental work illustrating the following:
Analysis: Composition of coal and gas, heat of combustion, viscosity. Mass transfer: Gas absorption, batch distillation, azeotropic distillation, fractional distillation and liquid-liquid extraction. Heat transfer: Condenser, shell and tube heat exchanger, heat loss from insulated pipes. Piping system design: Frictional energy loss through pipes and fittings. Measuring equipment: Rate of flow, temperature.

(CMO 320) **MASS TRANSFER 320, (16) 4-2-0, (C3)**
Separation by means of equilibrium stages. Degrees of freedom. Graphical and algebraic solutions of binary single-stage, multistage and batch distillation problems. Azeotropic distillation. Design of plate columns. Graphical and algebraic analysis of absorption, stripping and extraction stage processes.

(COM 420) **ENVIRONMENTAL MANAGEMENT 420, (8), 2-1-0, (C3, M3, B4, E4, N4, P4, R4, Z4)**
Introduction and environmental awareness. Integrated environmental management processes. Responsible care in industry. Environmental auditing. Environmental law in South Africa. Environmental impact and risk assessments. ISO 14000: the what and why. Environmental economics and public participation.

(COP 311) **TRANSFER PROCESSES 311, (16), 4-2-0, (C3, N3)**
Momentum transfer. Fluid statics. Control volume approach for conservation of mass, energy, and momentum. Application to pumps and turbines. Navier-Stokes equations,

derivation and applications. Laminar and turbulent boundary layer theory. Heat transfer: Fundamentals of heat transfer. Differential equations of heat transfer. Steady state conduction. Introduction to unsteady state conduction. Convection heat transfer and the thermal boundary layer. Radiation heat transfer. Mass transfer: Fundamentals of mass transfer. Diffusion and the diffusion coefficient. Differential equations of mass transfer. Steady state molecular diffusion in one or more dimensions.

(CPB 410) **PROCESS CONTROL 410, (16), 4-2-0, (C4)**
Dynamic properties of equipment, instruments and processes. Mathematical modelling and computer simulation of processes in the time, Laplace and frequency domains. Linearisation and non-linear processes. Stability of control systems. Controller tuning. Methods for process identification. Digital process control. Z-transforms. Use of computers and microprocessors. Introduction to modern control theory: State-space approach.

(CPD 320) **PROCESS DYNAMICS 320, (12), 2-2-0, (C3)**
Process dynamics: Time dependent behaviour of linear systems, linearisation. Transfer functions. Elements of a control loop. Control principles and mechanisms.

(CPJ 421) **DESIGN PROJECT 421, (32), 0-1-0, (C4)**
Application of chemical engineering principles for the complete design of a chemical plant.

(CPR 420) **PRACTICE 420, (16), 4-2-0, (C4)**
Design economics and process evaluation. Cost estimation and time-value of money. Applied process control. Choice of control instrumentation. Plantwide control strategy. Development of P & ID's. Safety: Site plan and layout, area classification, hazard and operability analysis (HAZOP). Occupational Safety and Health Act, Engineering Profession of South Africa Act.

(CPS 311) **PIPING SYSTEMS DESIGN 311, (8), 2-2-0, (C3, N3)**
Optimal-economic choice of diameters, pump types, control valves and flow meters. Application of the mechanical energy balance to single-phase, Newtonian, non-pulsating, non-compressible, isothermal fluids. Adjustments for multiphase, non-Newtonian, pulsating, compressible and non-isothermal flow systems.

(CPS 410) **PROCESS SYNTHESIS 410, (16), 4-2-0, (C4)**
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. Pinch analysis and exergy analysis. Flowsheet optimisation.

(CPY 311) **PRACTICAL TRAINING 311, (16), (C3)**
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 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.

(CPY 411) **PRACTICAL TRAINING 411, (16), (C4)**
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.

(CRO 410) **REACTOR DESIGN 410, (16), 4-2-0, (C4)**
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 fluidized. Modelling of non-ideal flow in reactors.

(CSC 411) **RESEARCH PROJECT 411, (16), 0-1-0, (C4)**
The execution of a complete literature study and research project on a chosen subject.

(CSC 421) **RESEARCH PROJECT 421, (16), 0-1-0, (C4)**
Interpretation of the research results of CSC 411. The writing of a project report and scientific article.

(CSQ 311) **COMMUNICATION 311, (8), 2-2-0, (C3)**
Discussion of practical training and aspects of the chemical engineering industry. Principles of effective communication and reporting. The elements of a good technical report. Sources of information and accessing. Communication.

(CSS 420) **SPECIALISATION 420, (16), 4-2-0, (C4)**
A postgraduate module to be selected from the list of available postgraduate modules. (Capita selecta from a list of available postgraduate modules.)

(CTD 311) **THERMODYNAMICS 311, (16), 4-2-0, (C3)**
The first and second laws of thermodynamics. Generalized correlations for physical and thermodynamic properties. Refrigeration and liquefaction of gases. Process efficiency by means of energy. Equilibrium composition in multiphase non-reacting systems with due allowance for non-ideality in the phases and the mixtures. Equilibrium compositions in reacting systems; also under conditions of non-ideality and competing reactions.

(EAD 410) **ELECTRICAL DRIVES 410, (16), 3-1-1, (E4)**
Single and three-phase DC-AC invertors, PWM, 4-quadrant conversion, DC and AC variable speed drives and high frequency transformer design.

(EAI 310) **INTELLIGENT SYSTEMS 310, (16), 3-1-1, (R3)**
Practical application of neural networks, fuzzy logic, genetic algorithms and expert systems. Introduction to pattern recognition, optimization and problemsolving using intelligent systems techniques.

(EAS 410) **COMPUTER ENGINEERING: ARCHITECTURE AND SYSTEMS 410, (16), 3-1-1, (R4)**
A systems approach to advanced computer architecture. The features of RISC and SISC architecture, detailed examination of the instruction cycle. Multiprocessor techniques. SIMD, MIMD and SISD systems.

(EAW 300) **ADVANCED WIRING 300, (4), (E3)**
This module is presented during one of the recess periods during the third year. The duration is one week. During this period the student will build on the material covered

during the module Practical Wiring EPW 200. Themes covered will relate to more advanced aspects of wiring practice, and further exposure to regulations and legislation as required. On completion of this module the student should be suitably prepared in order to apply for a wiring license. For practical reasons this module may be presented during another time slot, such as the beginning of the third year.

(EBB 320) **CONTROL SYSTEMS 320, (16), 3-1-1, (E3, R3, Z3)**
Modelling and simulation of physical systems. Block and signal flow diagrams. State variable formulation. Time and frequency domain analysis, continuous and discrete time. Stability and sensitivity. Design methods, cascade (eg. PID) and feedback controllers. Observers.

(EBT 410) **AUTOMATION 410, (16), 3-1-1, (E4, Z4)**
The general control problem and the role of sensors and actuators. Static and dynamic properties of measurement systems. Reliability, calibration and maintenance of instrumentation systems. Typical sensor elements as applied for the measurement of e.g. displacement, velocity, temperature, flow, pressure and force. Communication between the process and the control room. Typical plant automation issues. Computer platforms used in plant automation. Evaluation of automation systems. Lifecyclemodels for automation projects.

(EDF 320) **POWER ELECTRONICS 320, (16), 3-1-1, (E3)**
Semiconductor components: Power diodes, silicon-controlled-rectifiers, bipolar transistors, power mosfets, IGBTs, emerging devices. Passive components: Inductors, capacitors and transformers for power electronic applications. Ancillary issues: Heat sinks, snubbers, drive circuits. Converter topologies: AC-DC converters, DC-DC converters, DC-AC converters and AC-AC converters. Dynamics and control of power electronic converters. Applications: AC voltage controllers, Isolated high-frequency power supplies.

(EEM 410) **ENERGY SYSTEMS 410, (8), 3-1-1, (E4)**
Introduction to energy management: load factor, maximum demand, diversity, choosing voltages. Energy markets, Electricity pricing.

(EES 421) **SPECIALISATION FOR COMPUTER ENGINEERS 421, (16), 3-1-1, (R4)**
Specific niche areas from computer engineering are addressed.

(EES 422) **SPECIALISATION FOR ELECTRICAL ENGINEERS 422, (16), 3-1-1, (E4)**
Specific niche areas from electrical engineering are addressed.

(EES 423) **SPECIALISATION FOR ELECTRONIC ENGINEERS 423, (16), 3-1-1, (Z4)**
Specific niche areas from electronic engineering are addressed.

(EHB 410) **HIGH VOLTAGE CONTROL AND PROTECTION 410, (8), 3-1-1, (E4)**
High voltage testing, earthing and shielding, High voltage control: over-voltages, transients. Protective relays: philosophy of protective relaying, introduction to over-current protection, distribution system protection, transmission system protection, reticulation system protection. Sizing of protection devices.

(EHN 410) **e-BUSINESS AND NETWORK SECURITY 410, (16), 3-1-1, (R4)**
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.

(EKK 310) **POWER SYSTEM COMPONENTS 310, (16), 3-1-1, (E3)**
Transformers: the ideal transformer, equivalent circuit, single and three-phase transformers, auto-transformers, tap changing transformers. Synchronous machines: equivalent circuit, real and reactive power control, two-axis machine model. Transmission lines, Capacitors, Reactors, Single and three-phase induction motors, Load modelling.

(EKS 320) **ANALYSIS OF POWER SYSTEMS 320, (16), 3-1-1, (E3)**
Bus admittance matrix, Bus impedance matrix, Power flow analysis: Gauss Seidel and Newton Raphson methods. Balanced fault analysis, symmetrical components, unbalanced fault analysis. Introduction to power system stability.

(ELX 311) **ELECTRICAL MACHINES 311, (16), 3-1-1, (E3)**
Magnetic circuits: Flux, flux density, reluctance, hysteresis, MMF. Circuit principles: Balanced three-phase circuit analysis, per unit analysis. Machine principles: Torque, speed, efficiency and heat loss. Machinery: Power transformers, DC generators, DC motors, three-phase and single-phase induction motors, sinchrone machines.

(EMK 310) **MICROPROCESSORS 310, (16), 3-1-1, (E3, R3, Z3)**
General microprocessor architecture and assembly language, commonly available microprocessors (including DSP microprosessors), memory interfacing and address decoding, microprocessor input/output and interfacing, general programming concepts, general microprocessor system design principles, programmable logic, current trends and new processors (e.g. PICs for embedded systems).

(EMS 310) **MODULATION SYSTEMS 310, (16), 3-1-1, (R3, Z3)**
Spectral analysis using the Fourier and Z-transforms. Transform identities. Convolution and correlation. Linear System Theory. Analog and hybrid modulation systems: AM, PM, FM, PAM, PCM, Delta-modulation, PWM. Carrier synchronisation. Communication channels and transmission effects. Sampled Systems. Source digitization (D/A conversion), quantisation noise. Introduction to Information Theory and Source Coding. Formatting and line codes. Spectral characteristics of random data signals. Introduction to digital modulation. Binary modulation techniques: PSK, FSK and ASK. Symbol synchronization. PLL theory. Matched filter concepts. Analysis of digital modulation systems in AWGN. Simulation and practical implementation of simple digital communication building blocks and subsystems. The focus will be on analog modulation techniques as applied to radio communication systems.

(EMZ 310) **ELECTROMAGNETICS 310, (16), 3-1-1, (E3, Z3)**
Vector analysis, gradient, divergence, curl. Static electric fields. Static magnetic fields. Potential. Materials. Energy, magnetic circuits, force and torque. Faraday's law, time-varying fields, Maxwell's equations, potential functions and boundary relations. Introduction to transmission lines.

(EMZ 320) **ELECTROMAGNETICS 320, (16), 3-1-1, (Z3)**
Propagation and reflection of plane waves and power flow. Transmission lines; Smith Charts, matching networks, lossy lines. Waveguides; planar transmission lines, rectangular waveguides, resonant cavities. Antennas; antenna parameters, dipoles, linear arrays, aperture antennas, Friis transmission equation, radar equation.

(ENE 310) **ANALOGUE ELECTRONICS 310, (16), 3-1-1, (E3, Z3)**
Amplifier concepts: gain, input impedance, output impedance, bandwidth. Feedback, stability in amplifiers. Power dissipation and power efficiency. Bipolar and FET amplifier

design: bias and frequency response of small signal loaded single stage, multistage, differential stage, and feedback amplifiers. Large signal power amplifiers.

(ENE 410) **ADVANCED ELECTRONICS 410, (16), 3-1-1, (Z4)**
Operational circuits: Instrumentation amplifiers, logarithmic amplifiers, multipliers, oscillators, filters, translinear circuits and voltage regulators. Communication electronics: Wideband amplifiers, tuned RF amplifiers, AM and FM modulators and demodulators, phase-locked loops.

(ENM 311) **DIGITAL CIRCUITS AND MICROPROCESSORS 311, (16), 3-1-1, (E3)**
Digital circuits: Boolean algebra, gates, bi-stable circuits, registers, counters, A/D and D/A converters, multiplexers and peripheral equipment. Microprocessors: General microprocessor architecture and assembly language, commonly available micro-processors (including DSP microprocessors), memory interfacing and address decoding, microprocessor input/output and interfacing, general programming concepts, general microprocessor system design principles, programmable logic, current trends and new processors.

(EOK 320) **OPTICAL COMMUNICATION NETWORKS 320, (16), 3-1-1, (R3, Z3)**
Technology of optical networks: Optical fibre theory, optical fibre types, couplers, switches, multiplexers, light sources and detectors, receivers and receiver amplifiers, optical amplifiers (SOA and fibre amplifiers). Modulation and demodulation. TDM and WDM principles. Transmission systems (amplification, crosstalk, dispersion, fibre non-linearities, wavelength stabilisation). Design principles for WDM and DWDM systems. Optical networks: SDH. ITU-T. Broadcast and select networks (topologies): Wavelength routed networks. Virtual topology design. Control and management of networks. Protection and restoration. Optical network simulation tools. Design of optical communication networks: Performance criteria (S/N, BER, Eye diagrams). Measurement techniques and instrumentation (OTDR).

(EOV 320) **DESIGN AND MANUFACTURING 320, (16), 3-1-1, (E3, Z3)**
(EOV 321) **DESIGN AND MANUFACTURING 321, (16), 3-1-1, (R3)**
Systems theory, systems life cycle, systems engineering, design philosophy, generation of ideas, design for manufacturing and maintainability, configuration management and interfaces, packaging technology, manufacturing processes, CAD-CAM principles, production facilities and techniques, industry standards, safety standards, environmental requirements, ergonomics and aesthetics, man/machine interfaces, material procurement, logistics, complete design and construction of a system (including electro-magnetic compatability). Project management.

(EPE 321) **SOFTWARE ENGINEERING 321, (16), 3-1-1, (R3)**
Software Engineering deals with the application of engineering principles to the development and maintenance of high-quality software, with these goals in mind: functionality, timely delivery and budget concerns. The module will expose the students to various methodologies in the different stages of the software life cycle, the problems of group work, and software configuration management with CVS. Advanced programming skills including C++, Unix and TeX. Exposure to advanced programming and debugging techniques.

(EPR 400/402) **PROJECT 400/402, (16), 1-0-0 (1st semester), (48), 1-0-0 (2nd semester), (E4, R4, Z4)**
Project management and execution: The planning and execution of a given engineering

project from concept to delivery, the practical application of project management principles. Problem statement: Literature study; needs analysis, project planning and time scheduling; theoretical analysis and/or simulation and/or experimental work; synthesis (design and manufacture). Verbal reporting. Written report.

(EPY 422) **PRACTICAL TRAINING 422, (12), (E4, R4, Z4)**
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.

(ERN 310) **COMPUTER NETWORKS 310, (16), 3-1-1, (R3)**
Terminology of communication systems, hierarchy of protocols according to OSI model, applications to communication systems, high-speed networks, ISDN and distributed systems. LAN and WAN technologies.

(ESC 320) **STOCHASTIC COMMUNICATIONS SYSTEMS 320, (16), 3-1-1, (Z3)**
Review of signal theory. Introduction to stochastic processes: Stationarity and Ergodicity. Noise models. Channel models and transmission effects. Comparison of analogue and digital modulation systems in noise. Signal space concepts and geometric representation of signals. Statistical Communication Theory: Channel Capacity Theorem. Design and realization of binary and multi-level digital modulation systems. Spectral efficiency. Optimal receiver design: Matched Filter (MF) and Correlation-type Receiver structures. Nyquist and Partial-Response (PR) systems. Digital transmission through bandlimited AWGN channels: Inter-Symbol-Interference (ISI). Introduction to linear estimation: Equaliser algorithms and design. Introduction to channel (error correction) coding: Symbol-by-symbol versus maximum likelihood sequence estimation (MLSE) techniques. Block and convolutional codes. The focus will be on applications in the cellular and mobile communication fields where stochastic processes such as noise and channel effects are of prime importance.

(ESF 320) **DIGITAL COMMUNICATION SYSTEMS 320, (16), 3-1-1, (R3)**
Basic signals theory, transform theory (Fourier, Laplace and Z-transform) and linear Systems. Overview of stochastic processes: Stationarity and ergodicity. Noise and channel models. Transmission effects. Definition of information and coding of analog information sources. Shannon's Channel Capacity Theorem. Introduction to channel (error) detection and correction coding: Block and Convolutional coding. Maximum-likelihood sequence decoding: The Viterbi algorithm. Analysis of digital modulation techniques in AWGN. Optimal Receiver design. Nyquist and Partial-Response systems. Power Spectral Density (PSD) of random data signals. Digital Transmission through band-limited channels: ISI, Nyquist criteria and equalizers. Data communication standards and protocols. The focus will be on applications in the computer and network environments.

(ESP 411) **DSP: PROGRAMMING AND APPLICATION 411, (16), 3-1-1, (R4, Z4)**
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.

(ETN 322) **ELECTROTECHNICS 322, (16), 3-1-1, (M3)**
AC theory: Phasors, impedance, power, filters, resonance. Machines and transformers: Characteristics, construction, operation and equivalent circuits of direct current, synchronous and induction machines. Theory, use and maintenance of transformers. Electronics: Electronic components: bipolar and field effect transistors: analogue amplifier circuits, sensors (range, linearity, accuracy, stability, sensitivity, calibration), measuring techniques.

(ETN 420) **ELECTROTECHNICS 420, (16), 3-0-1, (M4)**
Digital circuits: Boolean algebra, gates, bistable circuits, registers, counters, A/D and D/A converters, multiplexers, microprocessors and peripheral equipment. Power systems: power supply, power factor and power factor correction, regulation, diversity, load factor and tariffs. Protection and reticulation.

(FBS 110) **FINANCIAL MANAGEMENT 110, (10) 3-0-0, (B3)**
Purpose and functioning of financial management. Basic financial management concepts. Accounting concepts and the use of the basic accounting equation to describe the financial position of a business. Recording of financial transactions. Relationship between cash and accounting profit. Internal control and the management of cash. Debtors and short-term investments. Stock valuation models. Depreciation. Financial statements of a business. Distinguishing characteristics of the different forms of businesses. Overview of financial markets and the role of financial institutions. Risk and return characteristics of various financial instruments. Issuing ordinary shares and debt instruments.

(GLY 151) **INTRODUCTORY GEOLOGY 151, (8), 4-0-1, (P3)**
See Faculty of Natural and Agricultural Sciences Yearbook

(GLY 152) **PHYSICAL GEOLOGY 152, (8), 4-0-1, (P3)**
See Faculty of Natural and Agricultural Sciences Yearbook

(GLY 161) **HISTORICAL GEOLOGY 161, (8), 4-0-1, (P3)**
See Faculty of Natural and Agricultural Sciences Yearbook

(GLY 162) **ENVIRONMENTAL GEOLOGY 162, (8), 4-0-1, (P3)**
See Faculty of Natural and Agricultural Sciences Yearbook

(GLY 254) **STRUCTURAL GEOLOGY 254, (12), 2-0-2, (P4)**
Integrated theoretical and practical module dealing with the principles of rock deformation and the analysis of deformed rocks. Stress, strain and rheology; fault systems, re-activation of faults, inversion tectonics, balanced cross-sections, folds, interference (superimposed folds); tectonic fabrics; shear zones, progressive deformation; mapping and analysis of deformed rocks, regional tectonics.

(GLY 361) **ORE DEPOSITS 361, (18), 2-0-2, (P4)**
Systematic review of major metallic and non-metallic ore types and examples in South Africa and world-wide; ore type models (grade and tonnage); geometry of ore bodies; mining; mining. Ore samples and ore mineralogy. Charting techniques.

(IPB 320) **PROJECT MANAGEMENT 320, (8) 2-1-0, (B2, C3, M3, N3, P3, S3)**
clickUP-supported module in project management from a business and system development perspective. Project management concepts: Application of project management, systems thinking, systems approach, technology, product, system and project life cycles, project phases. Development model: Market and client-oriented approach, stage-gate development process, development of a business case, project charter, systems engineering concept, system life cycle characteristics, marketing strategies. Planning and scheduling: Task definition, duration estimates, Gantt charts, network diagrams, CPM, resource allocation, resource levelling, Critical Chain. Costs and budgets: Cost estimates, project life cycle costs, escalation, work authorisation. Control: Control process, control of costs and schedules, buffer management, control of technical performance, project value, project management information systems. Organisation: Project team, project manager, teamwork and performance, support services, organisation structure for projects. Risk Management: Identification, analysis and resolution. Case studies and semester project.

(MBB 410) **CONTROL SYSTEMS 410, (16), 3-0-2, (M4)**
Introduction to control systems. Modelling of dynamic systems. Transfer functions. Block diagrams and block diagram algebra. Linearisation of non-linear systems. Disturbance signals. Steady-state accuracy. Control systems characteristics. Analysis of control systems using Laplace transformations. Root loci. Bode diagrams. Design of compensators using bode diagram and root locus design techniques. Controls laboratory.

(MII 420) **MAINTENANCE ENGINEERING 420, (16), 3-0-1, (M4)**
Introduction: Definition and objectives, statistical concepts. Mathematics of failure: Reliability concepts, fitting distribution to failure data. Maintenance management: Investment decisions, maintenance profit impact. Maintenance structure: Preventive, time based, condition based, corrective, design out. Data analysis: Renewable, repairable systems, Laplace trend test, analysis methodology. Optimizing maintenance strategies: Replacement/overhaul age, inspection frequencies, capital replacement, simulation. Reliability-Centred Maintenance (RCM). Maintenance systems: Components, structure, computer methods. Tribology: Friction laws, lubrication theory, contamination control. Maintenance Practice: Systems approach, management approach, modelling.

(MIR 322) **INTRODUCTION TO MECHANICAL ENGINEERING 322, (16), 3-1-1, (E3)**
Mechanics of machines: displacement, velocity and acceleration, acceleration and inertia forces. Theory of machines: machine elements like belt- and rope drives, clutches, shaft couplings, gears, cams. Vibration: vibration analysis, isolation and balancing. Strength of materials: bending moments, torsion, elasticity, stress and strain and shaft design. Fluid mechanics: fluid properties, hydrostatics, fluid dynamics, pipe friction and energy calculations. Thermodynamics: Laws of thermodynamics and energy balance, engine-, steam- and cooling cycles and basic heat transfer like conduction, convection and radiation.

(MLV 420) **AERONAUTICS 420, (16), 3-0-1, (M4)**
Introduction to aerodynamics and aeronautics. Fundamental physical quantities of flowing gas. Equations of state. Anatomy of an airplane. Atmospheriology. Basic aerodynamics. Elementary compressible flow. The Kutta-Joukowski Theorem. Introduction to viscous flow. Laminar and Turbulent Boundary Layers. Skin friction. Transition Flow Separation. Airfoil nomenclature. Lift, drag and moment coefficients. Pressure coefficients. Airfoil data. Wing properties. Circulation, downwash, and induced drag. Span efficiency. Stall. High-lift devices. Drag. Propeller theory. Elements of airplane and flight performance. Range, endurance and payload. Principles of static stability and control.

(MOW 312) **MACHINE DESIGN 312, (16), 3-3-0, (M3)**
Occupational Safety Act and codes, pressure vessels, design of ropes and lifting systems, design of gears and gear systems, springs, cams, material and material selection, tribology, lubrication and hydrodynamic bearings, contact stresses, ergonomics, costing, testing as part of the design process.

(MOW 323) **MACHINE DESIGN 323, (16), 3-5-0, (M3)**
Systems engineering applied within design like functional analysis, maintenance concept. Development of a small product. This part of the module is done in group context and the deliverable is a prototype of the product as well as a complete report. Steel structures, applications and codes also incorporating finite element analysis.

(MOX 410) **DESIGN 410, (16), 0-1-0, (M4)**
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.

(MPY 315) **PRACTICAL TRAINING 315, (16), (M3)**
During or at the end of the second year of study, students in Mechanical Engineering undergo prescribed practical training in the industry. The aim is exposure to engineering equipment and processes, the working environment of craftsmen and personnel relations. The duration is at least six weeks. A case study on personnel management must be done during this period and submitted, together with a satisfactory report on the practical training, 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.

(MPY 415) **PRACTICAL TRAINING 415, (16), (M4)**
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 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. In exceptional circumstances the prescribed minimum period can be reduced, as approved by the Chairman of the School of Engineering.

(MSC 400) **PROJECT 400, (8), 0-1-0 (1st semester), (16), 0-1-0 (2nd semester), (M4)**
The project involves the execution of an engineering project under guidance of a lecturer. This includes: analysis of the problem, literature and background study, complete planning (including co-aspects, available apparatus and required target dates), execution of the project (including complete calculations and working sketches of all apparatus and components to be manufactured), meaningful interpretation of the results and a complete written engineering report.

(MSX 310) **FLUID MECHANICS 310, (16), 3-0-1, (M3)**
The Navier-Stokes and continuity equations. Definitions and properties of fluids, fluid statics, fluid dynamics, Euler and Bernoulli equations, momentum equation, laminar and turbulent flow, pipe friction and networks, measurements of flow, dimensional analysis. Experimental technique in fluid mechanics.

(MSY 310) **STRUCTURAL MECHANICS 310, (16), 3-0-1, (M3)**
Section A: Introduction to structural analysis using the finite element method: FEA process. Direct stiffness method. Spring, bar and beam elements. Slope deflection equations. Co-ordinate transformations. Analysis of statically indeterminate trusses and frames. Internal hinges. Continuous loads. Continuous beams with normal loads. Computer assignments.
Section B: Failure analysis: Fatigue-finite life-SN approach: Analysis methods. Influencing factors. Non-zero means. Cumulative fatigue damage. Rainflow cycle counting. Elastic instability: Euler theory. Equivalent length. Eccentric loads. Secants equation. Linear elastic mechanics: Stress intensity factor. Fracture toughness. Fatigue crack growth. Structural fatigue testing: Multi-axial simulation testing. Experimental techniques in structural mechanics.

(MSY 411) **COMPUTER-AIDED STRUCTURAL MECHANICS 411, (16), 3-0-1, (M4)**
Theory of elasticity: Stress and strain vectors and tensors, transformations, equilibrium, surface traction, principal stress. Deformation and strain: Stretch and shear, infinitesimal strain. Material laws: Linear elasticity, plane stress, plane strain. The boundary value problem. Potential energy, stationary principles, Galerkin, Rayleigh-Ritz. The finite element method in solid mechanics (FEM): Bar analysis: equilibrium, compatibility, material laws, approximation functions, strain operator, stiffness matrix, solution, stress. Plane stress, plane strain: Triangular and rectangular elements, body and boundary forces, solution. Constant strain triangle, linear strain triangle. Isoparametric formulations, numerical integration.
Practical considerations in modelling, computer application, convergence, the patch test. Derivative free optimization methods and structural optimization: Particle swarm optimization algorithm, genetic algorithm, Pareto-optimality.

(MTV 420) **THERMAL AND FLUID MACHINES 420, (16), 3-0-1, (M4)**
(i) Thermodynamics: Introductory thermodynamics with reference to power cycles. Energy systems and views, transformation of energy. Nuclear power. (ii) Steam generators: Work fluids, fire-tube boilers, water-pipe boilers, heat exchange boilers, power nuclear reactors. Feedwater. Industrial uses of steam. (iii) Combustion technique: Types of fuels – oil, coal, gas; their combustion methods. Ash and its properties. Air pollution. (iv) Steam engines: Turbo machine theory; types of turbines – properties and uses. Blades, rotors, sealing, balancing. Parallel operation of turbo generators in a power network. (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. (iii) Applications: specific speed, cavitation, water hammer. Pump connections: pipe system connections. Pumping of solids. Air-pressure systems. (iv) Turbo machines: turbo machine theory. Impulse and reaction turbines. Analytical analysis. Characteristics: applications; integration of hydroturbines with power systems.

(MTX 321) **THERMODYNAMICS 321, (16), 3-0-1, (M3)**
Ideal and real gases. Supersonic flow through nozzles. Irreversibility and availability. Refrigeration cycles. Mixtures of gases. Combustion. Combustion in internal combustion engines. Engine analysis using engine cycles. Experimental techniques in thermodynamics.

(MVE 420) **VEHICLE ENGINEERING 420, (16), 3-0-1, (M4)**
Tyres: Construction, forces and moments, side force generation, rolling resistance, dynamic characteristics, tractive effort, slip, soft soil characteristics. Vehicle performance: equations of motion, supply and demand, forces acting on the vehicle, prediction of top speed, acceleration, braking, gradient ability and fuel consumption. Vehicle suspension systems: suspension concepts, kinematics, dynamic characteristics. Ride comfort: springs, dampers, suspension models, human response to vibration. Handling: steering systems, low-speed handling, steady-state handling, dynamic handling, under/oversteer, handling tests.

(MVR 320) **VIBRATION AND NOISE 320, (16), 3-0-1, (M3)**
Introduction to vibration. Single degree of freedom systems: free vibration, harmonic excitation, general excitation. Multidegree of freedom systems. Continuum systems. Sound and noise. Vibration control. Vibration and sound measurement.

(MWX 410) **HEAT TRANSFER 410, (16), 3-1-1, (M4)**
General principles. Conduction, steady and unsteady states, applications. Conduction in two dimensions. Similarity and dimensional analysis. Convective heat transfer, forced convection, natural convection. Boiling calculations. Radiation. Heat exchangers. Experimental techniques in heat transfer.

(NEX 300) **EXCURSIONS 300, (8), 1-0-2, (N3)**
Attendance of and participation in industrial excursions organised during the year, including a four-day excursion tour at the end of the first semester. Submission of reports and assignments as required.

(NHM 311) **HYDROMETALLURGY 311, (16), 3-0-4, (N3)**
Thermodynamics and kinetic principles of hydrometallurgical and electrometallurgical processes. Principles of leaching. Electrochemical principles of cementation, electrowinning and electrorefining. Relevant analytical methods.

(NHM 321) **HYDROMETALLURGY 321, (16), 3-0-2, (N3)**
Extraction routes and the extractive metallurgy of gold and copper. Aspects of unit processes such as leaching, concentration and purification, as well as reclamation. Practicals: experimental characterisation of key aspects of extraction processes.

(NHM 411) **HYDROMETALLURGY 411, (8), 3-1-0, (N4)**
Extraction routes and the extractive metallurgy of metals such as zinc, manganese, nickel, cobalt, uranium and the platinum group elements. Aspects of unit processes such as leaching, concentration and purification, as well as reclamation. Reactor theory and analytical characterisation of process solids and solutions.

(NKR 411) **CORROSION 411, (8), 3-0-1, (N4)**
Electrochemistry of corrosion. Mechanisms, measurement and prevention of different corrosion phenomena. Practical: one group project.

(NMC 312) **MATERIALS SCIENCE 312, (16), 3-0-4, (N3)**
Physical metallurgy of light metals. Nickel-based and copper-based alloys. Kinetics of phase transformations. Specialised analytical techniques. Polymer engineering and applications.

(NMM 320) **MECHANICAL METALLURGY 320, (16), 3-0-4, (N3)**
Dislocation theory. Room temperature deformation and mechanical testing. Creep deformation. Fracture mechanics. Failure analysis. Hot and cold rolling of metals.

(NMP 322) **MINERALS PROCESSING 322, (16), 3-0-2, (P3)**
Main factors affecting the economic nature of a mineral deposit. Analytical techniques that can be used to assess the properties of the deposit. Mass balancing and introduction to data reconciliation. Properties of minerals on which concentration processes are based. Comminution: overview of different types of crushers and mills, basic theory and mechanisms. Classification and screening, hydrocyclones and screens. Separation processes: gravity concentration, theory and functioning of spirals, jigs, shaking tables and high-speed centrifugal separators. Dense medium separation, theory of separation and properties of the medium. Chemical and physical aspects of froth flotation. Introduction to sampling, tailings disposal and dewatering. Typical flowsheets for platinum, gold, heavy minerals and coal.

(NMP 323) **MINERALS PROCESSING 323, (16), 3-0-4, (N3)**
Main factors affecting the economic nature of a mineral deposit. Analytical techniques that can be used to assess the properties of the deposit. Mass balancing and introduction to data reconciliation. Properties of minerals on which concentration processes are based. Comminution: Overview of different types of crushers and mills, basic theory and mechanisms. Classification and screening, hydrocyclones and screens. Separation processes: Gravity concentration, theory and functioning of spirals, jigs, shaking tables and high-speed centrifugal separators. Dense medium separation, theory of separation and properties of the medium. Chemical and physical aspects of froth flotation. Introduction to sampling, tailings disposal and dewatering. Typical flowsheets for platinum, gold, heavy minerals and coal. Introduction to process simulation by making use of LIMN.

(NMP 411) **MINERALS PROCESSING 411, (16), 3-1-2, (N4)**
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.

(NOP 420) **PROCESS DESIGN 420, (28), 3-1-0, (N4)**
Philosophy of design and the design process. Principles of project planning and management. Unit and process design, simulation, economic evaluation and optimising as applicable to the metallurgical industry. Execution of a process design project and submission of a report.

(NPB 411) **PROCESS METALLURGY AND CONTROL 411, (16), 4-3-0, (N4)**
Quantification of the equilibria, kinetics and transient heat transfer of high-temperature processes, for process analysis and design. Elements of metallurgical process control.

(NPM 321) **PYROMETALLURGY 321, (16), 3-2-0, (N3)**
Fundamentals governing pyrometallurgical processes; Gibbs free energy, equilibrium constants, Henrian and Raoultian activities; slag basicity and viscosity; energy sources and reductants used in pyrometallurgical processing; equilibrium of iron and steelmaking reactions; equilibrium reactions in non-ferrous pyrometallurgy; analysing and proposing processing conditions for ferrous and nonferrous production.

(NPW 410) **METALS PROCESSING AND WELDING 410, (16), 4-0-2, (N4)**
Liquid metal processing. Sheet metal processing. Welding processes. Surface processing and hard facing. Processing for fatigue resistance; fatigue of welded structures. Soldering and brazing. Metallurgy of welding and the heat-affected zone. Welding of carbon steels, cast irons and non-ferrous alloys. Metallurgy and welding of stainless steels. Welding codes, specifications, quality assurance.

(NPY 316) **PRACTICAL TRAINING 316, (16), (N3)**
During or at the end of the second 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.

(NPY 416) **PRACTICAL TRAINING 416, (16), (N4)**
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 411) **PROJECT 411, (8), 0-1-0, (N4)**
Background work for the research project (to be completed in the second semester). Topics for this semester: Literature search, hypothesis formulation, preliminary experimental planning, literature survey, and final experimental planning; presentation on literature survey.

(NSC 421) **PROJECT 421, (44), 0-1-0, (N4)**
Continuation of the project which was initiated in the first semester. Execution of the experimental and analytical work. Submission of a detailed project report; oral presentation of the preliminary and final results. Poster presentation on final results.

(NVM 311) **REFRACTORY MATERIALS 311, (8), 2-2-0, (N3)**
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.

(PDY 311) **SURFACE MINING 311, (16), 3-1-2, (P3)**
Mining methods for open pits and strip mines. Drilling and blasting practice, face shovels and loading methods. Truck transport, roads, truck allocation and electrical trolley assist. Dragline operations and strip mining practices. Continuous transport systems and in-pit crushers. Bucket wheel excavators. Economic cut-off limits with regards to waste stripping and ore grade. Basic computerized mine planning.

(PEE 320) **MINE ENVIRONMENT ENGINEERING 320, (16), 3-1-2, (P3)**
This module is subdivided into 6 study themes. 1. Flow analysis: Basic mine flood flow, theory (air and water flow), ideal fluids, pressure aspects, Bernouilli, laminar and turbulent flow. 2. Psychrometry: Psychrometric characteristics. 3. Thermodynamic aspects of mine air: Changing and constant moisture content, pressure measurements, mechanical

influence/effect of air. 4. Heat Sources: Different sources of heat, conduction, convection, and radiative heat flow, overall heat transference coefficients. 5. Compressed air: various aspects related to compressed air. 6. Water flow: Laminar and turbulent flow, water flow measuring, techniques, water flow and energy considerations, water reticulation underground (supply and removal).

(PEE 410) **MINE ENVIRONMENT CONTROL ENGINEERING 410, (16), 3-1-2, (P4)**
Mine ventilation methods: primary and secondary ventilation methods, different stoping methods air supply, different types of ventilation strategies for coal and massive ore deposits, development ventilation. Mine air control: knowledge and understanding of the different types of fans that are being used underground, difference between centrifugal fans, axial flow fans, mixed flow fans and be able to give the various applications for each, air control methods, application of the fan performance curves, concepts of electrical power, curve and efficiency, the effect of velocity, density and ventilation pressure, semi-serie and semi-parallel fan placements and air ducting, various control methods for centrifugal and axial flow fans. Refrigeration: basic refrigeration concepts and definitions for a simple chilled water system, vapour compression refrigeration units, refrigerants, pressure enthalpy diagrams, refrigeration plant components, various types of cooling distribution methods. Occupational hygiene: definitions, responsibilities and stress factors, anatomy, pathology, physiology, heat stress, heat balance for humans, illumination, noise, toxicology, ergonomics. Mine gases, their sources and gas/coal dust explosions: dangers, most common gases, gas detection techniques, control measures, flammable gases underground, coal dust explosions underground, Coward's and USBM triangles and the application of each. Mine dust and associated ionising radiation: mine dust and the dangers, dust sampling and measurements, TWA calculations, Hund Tyndallo meter. Mine ventilation planning: basic planning parameters for different mining methods, ventilation and cooling requirements for a deep hot mine, ventilation planning for a coal mine, using the VUMA simulation tool to solve networks for mines. Mine ventilation economics: basic economic concepts and calculations, knowledge and understanding of the effect of depreciation on tax and eventual profit of the project, effect of tax on the profitability, effect of depreciation on the eventual profit, the internal rate of return (IRR).

(PME 310) **MINERAL ECONOMICS 310, (16), 3-2-0, (P3)**
An introduction and general overview of Mineral Economics. The impact of minerals on an economy, classification of natural resources, most important minerals in South Africa. Micro and macro-economics. Supply and demand of minerals, minerals marketing and strategic policies.

(PMY 410) **MINING 410, (16), 3-1-2, (P4)**
Specific mining techniques. Shafts: Types, methods and equipment for sinking; economic considerations. Tunneling: 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 422) **MINING 422, (8), 2-1-0, (P4)**
Selected topics in risk and safety management: Methodology and techniques of risk identification, risk assessment, and mitigation principles. Competence based safety: Human error model, risk perception, risk competency. Safety Leadership: Transactional leadership and transformational leadership. Safety and Mineral Statistical Structures and Codes: SAMREC, SAMRASS, SIMRAC codes, functions and duties.

(PMZ 421) **MINE DESIGN 421, (40), 0-5-0, (P4)**
Design a mine at the conceptual study level. This module is the final rounding-off of the Mining Engineering Degree, in which the candidate applies all he/she has learnt during the first seven semesters of the engineering curriculum. The objective of the module is to design a mine around a given ore body, write a report on the mine design, and to make an oral presentation on the mine design. The mine design will consist of a market survey of the mineral commodity concerned, an environment impact analysis, the development of a geological model, geostatistical analysis of the ore body, ore reserve calculations, and the selection of an applicable mining method considering technical, financial, and safety aspects. The design will include positioning of shaft systems, key cuts, surface infra-structure, production scheduling, capital and operating cost estimates, and a financial and technical evaluation, including a risk analysis. There will be a short series of lectures on selected technical aspects of mine design that have not been covered before, for example geostatistics and its application to ore reserve evaluation. Other aspects will also be covered where these are applicable to the mine design.

(PNB 300) **INDUSTRIAL EXCURSIONS 300, (8), 0-0-3, (P3)**
Attendance at and participation in an industrial excursion organised during the year, including a ten-day tour at the end of the first semester. Submission of reports and assignments as prescribed.

(PNB 400) **INDUSTRIAL EXCURSIONS 400, (8), 0-0-3, (P4)**
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 prescribed.

(PPY 317) **PRACTICAL TRAINING 317, (16), (P3)**
Mining students must undergo at least six weeks prescribed practical training at a mine at the end of the second year of study. A satisfactory report on such work must be submitted to the Department within one week after registration. Arrangements must be made for a further prescribed training period of at least six weeks at the end of the third year of study.

(PPY 418) **PRACTICAL TRAINING 418, (16), (P4)**
Mining students must undergo at least six weeks prescribed practical training at a mine at the end of the third year of study. A satisfactory report on such work must be submitted to the Department within one week after registration.

(PRX 311) **ROCK BREAKING 311, (16), 3-1-2, (P3)**
Rock breaking: Specific energy of rock breaking. Energy transfer from drill to rock. Performance of hammer, rotary, diamond and drag-bit drills. Economic aspects and drill selection criteria. Mechanical tunnelling and equipment. Novel rock-breaking methods. Explosives: properties of commercial explosives, detonation mechanisms, energy release, shock energy and gas pressure. Timing with different accessories. Blasting: explosive/rock interactions, rock breaking mechanisms. Blast design for tunnelling, shaft construction, stoping and coal mining. Importance of safety during blasting operations.

(PSC 321) **INTRODUCTION TO PROJECT 321, (8), 0-1-0, (P3)**
Identification of a suitable subject for Project 410. Submission of a detailed literature study with accompanying report. Planning of project execution.

(PSC 410) **PROJECT 410, (8), 0-1-0, (P4)**
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. Information for the approved project will be collected during the practical training period at the end of the third year of study. A comprehensive and detailed project report must be submitted on the prescribed date.

(PSZ 321) **ROCK MECHANICS 321, (16), 3-1-2, (P3)**
Stress and strain in solid materials. Elasticity. Strength and failure modes of rock material and rock failure criteria. The characteristics of joints in rock. Collection of joint information and interpretation thereof. The characteristics of a rock mass, classification methods and determination of strength. Rock failure due to gravity. Slope stability, joint failure, wedge failure, circular and non-circular failure in surface mines.

(PSZ 410) **STRATA CONTROL 410, (16), 3-1-2, (P4)**
Mine safety and ground falls: Seismicity and rock bursts in mines, control of energy releases during mining. Energy release rates and excessive shear stress criteria. Backfilling and regional support lay-outs. Support of underground slopes, service excavations. Lay-out of mining excavations. Strata control in coal mines, board and pillar workings, high extraction coal mines, shafts and massive mining operations. Application of stress analysis methods in design of excavations, surface subsidence.

(SBM 321) **CIVIL BUILDING MATERIALS 321, (16), 3-1-2, (S3)**
The behaviour, properties and application of cement and concrete products, structural steel, structural timber, fibre reinforcing, polimers, masonry work, epoxies and bituminuous materials.

(SBZ 310) **CIVIL CONSTRUCTION ECONOMICS 310, (8), 2-1-1, (S3)**
The effective use and application of economic principles for engineering decision making. In the study of this module, skills are developed through the use of computer software to understand the concept of time value of money, determine the life cycle of assets, select alternatives that are financially the most beneficial, choose between alternative types of financing and solve engineering economy related problems.

(SBZ 420) **CIVIL CONSTRUCTION MANAGEMENT, (16) 4-1-1, (S4)**
Planning, needs assessment and performance indicators for contracts. Civil Engineering Project: Client, consultant and contractors expectations and responsibilities. Tender process, construction process, Application of OHS Act and Mine, Health and Safety Act, Conditions of Contract and Claims, Insurances, Engineering Economics, Programming, Costing, 1509001: Quaity Management Systems, Life cycle concepts, Maintenance cycle, Maintenance Management.

(SDC 420) **DESIGN CONCEPT 420, (8) 2-0-1, (S4)**
Design integration is achieved within civil as well as functional shells. Fundamental understanding of both the functional, as well as the technical aspects, particular to the planning and design of multi-disciplinary engineering projects is developed. Typical building projects, office complexes, retail and residential developments are used as examples. This module will address an understanding of the development of the footprints and building envelope. Concept designs obtained from the department of Architecture are used to introduce the student to design integration.
The student functions within a team allowing an exchange of ideas. The development of

conceptual design skills is achieved by focusing on the particular stages in the design process.

(SDO 420) **DETAIL DESIGN 420 (24) 5-1-1, (S4)**
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

The applications selected for each discipline may vary from year to year.

(SEV 421) **ENVIRONMENTAL GEOTECHNOLOGY 421, (16) 4-1-1, (S4)**
Regulatory framework, site investigation, site restoration, and waste disposal. Site characterisation methods. Waste types and properties. Subsurface contaminant transport. Multiphase fluid flow. Design of waste containment and waste disposal systems. Review of remedial alternatives with emphasis on in situ technologies. Case histories. Integrated environmental management processes. Environmental legislation in SA. Environmental impact, environmental auditing and risk analysis. ISO 140000: what it entails and how it is applied. Community participation.

(SGM 311) **SOIL MECHANICS 311, (16), 3-1-2, (S3)**
Introduction to soil mechanics. Introduction to clay mineralogy. Mass, volume relationships and phases of soil. Groundwater flow and permeability. Effective stress principles. Suction pressures in saturated as well as partially saturated soil. The Mohr circle and stresses at a point. The Mohr-Coulomb strength theory and the stress-strain properties of soil. The Boussinesq theory. Consolidation theory and soil settlement.

(SGM 323) **GEOTECHNICAL ENGINEERING 323, (16), 3-1-2, (S3)**
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 Couloumb's methods. Slope stability including Bishop's method of slices. Introduction to site investigation.

(SHC 310) **HYDRAULICS 310, (16), 4-1-1, (S3)**
Kinematics, measuring flow rate and velocity, potential flow, real fluids, pipe flow, pipe networks and municipal services.

(SHC 320) **HYDRAULICS 320, (8), 2-0-1, (S3)**
Pumps, water hammer analyses, free service flow and physical model analyses.

(SHC 410) **HYDRAULICS 410, (16), 4-1-1, (S4)**
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.

(SIB 310) **TIMBER DESIGN 310, (8), 2-1-0, (S3)**
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.

(SIB 320) **CONSTRUCTION MANAGEMENT AND EQUIPMENT 320, (8), 2-1-0, (S3)**
Construction equipment: Introduction of basic construction equipment, pre-planning, production planning, working techniques. Contract documentation: Bill of Quantities and specifications.

(SIN 311) **STRUCTURAL ANALYSIS 311, (8), 2-1-1, (S3)**
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, (8), 2-1-1, (S3)**
Stability of beams. Material properties. Analysis and limit states design of tension, compression and flexural members, and beam-columns. Design of trusses, simple framed structures and connections.

(SIN 324) **REINFORCED CONCRETE DESIGN 324, (8), 2-1-1, (S3)**
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. Calculation of deflection and crack width.

(SIN 411) **STEEL DESIGN 411, (8) 2-1-1, (S4)**
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, (8), 2-1-1, (S4)**
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.

(SPV 420) **PUBLIC PRESENTATION 420, (8) 1-1-1, (S4)**
The course focuses on three aspects of professional communication and presentation: a poster, a report and a spoken presentation. The student is expected to prepare examples of each. The work will be done in groups and individually. Issues of style, vocabulary, structure and graphical presentation of technical information will be considered.

(SPY 410) **PRACTICAL TRAINING 410, (16), (S4)**
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 411) **RESEARCH PROJECT 411, (32), 0-2-0, (S4)**
In the first semester,two day of the week must be used by final-year students for the execution of an analytical and/or experimental research project.

(SVC 310) **TRANSPORTATION ENGINEERING 310, (8), 2-1-0, (S3)**
Introduction to transportation engineering; analysis of transport systems; traffic flow;

shock waves, queuing systems, light traffic flow theory, capacity and service levels, traffic data and surveys, economical aspects of transport systems, introduction to railway engineering.

(SVC 324) **HIGHWAY DESIGN 324, (8), 2-1-0, (S3)**
Vehicle characteristics; geometric road design, cross-section, horizontal and vertical alignment; road quantities and mass haul diagrams; urban streets; layout considerations and intersection design, traffic safety.

(SVC 411) **TRANSPORTATION PLANNING 411, (8), 2-1-0, (S4)**
System approach, transport planning models, trip generation, trip distribution, modal split, trip assignment, model calibration, transport networks, impact of transport on society, environment and land use, intelligent transport systems (ITS), transport demand management (TDM), public transport, current policy and planning in South Africa, traffic impact studies.

(WTW 338) **MATHEMATICS 338, (16), 4-2-0, (C3, E3, M3)**
Linear algebra, eigenvalues and eigenvectors. First and second order systems of differential equations. Applications. Partial differential equations with applications. Numerical methods (finite difference) for partial differential equations. Complex functions: Analytic functions, power series and integrals in the complex plane.

(WTW 342) **STOCHASTIC PROCESSES 342, (16), 4-2-0, (R3, Z3)**
Fourier transforms and the mathematical properties of signals, mathematical formulations of a number of probability models, properties of multiple random variables, stochastic processes and linear time-invariant systems, complex functions.

PRIZES AND MEDALS

Name	Donor	Award
Faculty of Engineering, Built Environment and Information Technology		
Medal of the Vice-Chancellor and Principal	University of Pretoria	The award comprises a silver medal as well as a cash prize and is awarded to candidates for outstanding academic achievement during the undergraduate years of study for any first bachelor's degree in a faculty.
S_2A_3 Bronze Medal	The South African So-ciety for the Promotion of Science	The medal is awarded to a student who has completed an exceptionally meritorious master's study in a field traditionally linked to the activity of the South African Society for the Promotion of Science (S_2A_3).
School of Engineering		
Medal of the Engineering Council of SA	Engineering Council of SA	For the most outstanding achievement in the final year in the School of Engineering
Minerals Education Trust Fund Prize	Minerals Education Trust Fund	Bursary for postgraduate studies and medal for the most outstanding finalist in Chemical, Metallurgical or Mining Engineering.
Five-year Study Programme (all departments)		
Prizes for the best academic achievement	Firms and institutions which contribute to the Academic Development Programme in the School	For the first-year student registered for the JPO modules who achieved the highest average mark in all the prescribed modules of the first year of study.
Department of Chemical Engineering		
Medal of the SA Institution of Chemical Engineers	SA Institution of Chemical Engineers	For the best final-year student in Chemical Engineering
Department of Civil Engineering		
Fourth-year Prizes/Awards for the best final-year student in:		
BKS – DW de Vos Medal	BKS Incorporated	In the final year of study (R4 000)
Stewart Scott International Prize (SSI)	Stewart Scott International (SSI)	For the most innovative research project (R2 500)
SA Institute for Steel Construction Prize	SA Institute for Steel Construction	In Steel Design SIN 411 (R1 500)
ITS Prize	ITS (Pty) Ltd	In Transportation Planning SVC 411 (R1 000)
Third-year Prizes for the best third-year student in:		
BKS – GPR von Willich Prize	BKS Incorporated	The third year of study (R1 000)

Name	Donor	Award
VGI Prize	Venter and Grobler Consulting Engineers	Transportation Engineering SVG 310 (R1 000)
Vibro Prize	Vibro Bricks (Pty) Ltd	Highway Design SVG 324 (R1 500)
Vibro Prize	Vibro Bricks (Pty) Ltd	Civil Building Materials SBM 321 (R1 500)
Dekker en Gelderblom Prize	Dekker & Gelderblom	In Steel Design SIN 323 (R750)
Dekker en Gelderblom Prize	Dekker & Gelderblom	In Reinforced Concrete Design SIN 324 (R750)
Raubex Prize	Raubex Construction (Pty) Ltd	Civil Construction Economics SBZ 310 (R2 000)
Departmental Water Engineering Prize	University of Pretoria	In Hydraulics SHC 310 (R750)
Second-year Prize		
BKS-GPR von Willich Prize	BKS Incorporated	For the best student in the second year of study (R1000)
Departmental Water Engineering Prize	University of Pretoria	In Water Treatment SHC 220 (R250)
First-year Prize		
Departmental Prize	DW de Vos Training Fund	For the best first-year student (R500)
Department of Electrical, Electronic and Computer Engineering		
Louis van Biljon Prize and Gold Medal	Firms and institutions in the field of Electronic Engineering	For outstanding achievement in the third and fourth years of study in Electronic Engineering (Gold medal)
Louis van Biljon Prize and Silver Medal	Firms and institutions in the field of Electronic Engineering	For outstanding achievement in the third and fourth years of study in Electronic Engineering (Silver medal)
Louis van Biljon Prize and Bronze Medal	Firms and institutions in the field of Electronic Engineering	For outstanding achievement in the third and fourth years of study in Electronic Engineering (Bronze medal)
Gustav Heyman Prize and Gold Medal	Firms and institutions in the field of Electrical Engineering	For outstanding achievement in the third and fourth years of study in Electrical Engineering (degree with distinction) (Gold medal)
Gustav Heyman Prize and Silver Medal	Firms and institutions in the field of Electrical Engineering	For outstanding achievement in the third and fourth years of study in Electrical Engineering (degree with distinction) (Silver medal)
Gustav Heyman Prize and Bronze Medal	Firms and institutions in the field of Electrical Engineering	For outstanding achievement in the third and fourth years of study in Electrical Engineering (degree with distinction) (Bronze medal)

Name	Donor	Award
Wilhelm Leuschner Prize and Gold Medal	Firms and institutions in the field of Computer Engineering	For outstanding achievement in the third and fourth years of study in Computer Engineering (degree with distinction) (Gold medal)
Wilhelm Leuschner Prize and Silver Medal	Firms and institutions in the field of Computer Engineering	For outstanding achievement in the third and fourth years of study in Computer Engineering (degree with distinction) (Silver medal).
Wilhelm Leuschner Prize and Bronze Medal	Firms and institutions in the field of Computer Engineering	For outstanding achievement in the third and fourth years of study in Computer Engineering (degree with distinction) (Bronze medal).
1st prize for the Modulation Maestro	RapidM	For the best third-year Electronic/Computer Engineering student in the module Modulation Systems (R5000)
2nd prize for the Modulation Maestro	RapidM	For the second best third-year Electronic/Computer Engineering student in the module Modulation Systems (R3000)
3rd prize for the Modulation Maestro	RapidM	For the third best third-year Electronic/Computer Engineering student in the module Modulation Systems (R2000)
1st prize for the Digital Guru	RapidM	For the best third-year Computer Engineering student in the module Digital Modulation Systems (R5000)
2nd prize for thee Digital Guru	RapidM	For the second best third-year Computer Engineering student in the module Digital Modulation Systems (R3000)
3rd prize for the Digital Guru	RapidM	For the third best third-year Computer Engineering student in the module Digital Modulation Systems (R2000)
Project Genius Prize in the Signal Processing & Telecommunication Group	RapidM	For the final-year Electronic/ Computer engineering student with the best signal processing and telecommunications project (R10 000). The student must achieve a distinction in the final year Project Module.
First National Bank Innovation Prize	First National Bank	For the final-year student with the most innovative computer systems and networks project (R10 000)
SA Institute of Measure and Control/Schneider Automation Prize	WSP Group	For the best final-year project in Measurement and Control.(R1 300 plus gold medal)

Name	Donor	Award
SAMES Prize	South African Microelectronic Systems	For the best final-year project in Electronic Engineering in the specialist field of Microelectronics (R2 000) *(The donor has the prerogative to award two prizes of R2 000 each to two students should their achievement be of equal standard.)*
ABB Powertech Transformers Prizes	ABB Powertech Transformers (Pty) Ltd	1. For the best final-year project in Electrical Engineering (R2 000) 2. For the best final-year student in the module Electrical design (R1 000)
Mintek Prize	Mintek	For the best final-year student in the module Automation (R1 000)
Gendac Prize	Gendac	For the best final-year project in software engineering (R10 000)
Gendac Prize	Gendac	For the second best final-year project in software engineering (R8 000)
Gendac Prize	Gendac	For the third best final-year project in software engineering (R6 000)
Parsec VHDL Prize	Parsec Design Solutions (Pty) Ltd	For the best final-year project in Computer Engineering (R3 000 plus a voucher to attend the VHDL course the following year)
SAIEE Prize	South African Institute of Electrical Engineers	For the best third-year student in Electronic Engineering (R750)
SAIEE Prize	South African Institute of Electrical Engineers	For the best third-year student in Electrical Engineering (R750)
SAIEE Prize	South African Institute of Electrical Engineers	For the best third-year student in Computer Engineering (R750)
IST Prize	IST	For the best third-year student in the module Control Systems (R1 000)
Department of Industrial and Systems Engineering		
Medal of the Southern African Institute of Industrial Engineering	Southern African Institute for Industrial Engineering	For the best final-year student in Industrial Engineering
Magna FS Prize	Magna FS	For the best first-year student in Industrial and Systems Engineering
Fourier Approach Prize	Fourier Approach	For the best second-year student in Industrial and Systems Engineering

Name	Donor	Award
iPlan Prize	iPlan Industrial Engineers	For the best third-year student in Industrial and Systems Engineering
Sasol Prize	Sasol Ltd	For the most outstanding consistent academic achievement for the duration of the degree programme
Department of Mechanical and Aeronautical Engineering		
C A du Toit Prize and Medal	C A du Toit and Partners	Awarded in the final year for excellence in the module of Heat Transfer.
Sasol Merit Medal	Sasol Ltd	For the best second-year student in Mechanical Engineering (R750)
Sasol Merit Medal	Sasol Ltd	For the best third-year student in Mechanical Engineering (R1 000)
Sasol Merit Medal	Sasol Ltd	For the best final-year student in Mechanical Engineering (R1 500)
Sasol Merit Medal	Sasol Ltd	Awarded for excellence in Design in the third year of study (R1 000)
Sasol Merit Medal	Sasol Ltd	Awarded for excellence in Design in the final-year of study (R1 500)
Sasol Merit Medal	Sasol Ltd	For the best Master's student in Mechanical Engineering (R2 000)
Aluminium Federation of Southern Africa Prize	Aluminium Federation of Southern Africa	For the group of students in the second year of study who made the best use of a donated sheet of aluminium (R1 000)
Prizes in the Department of Mechanical and Aeronautical Engineering are awarded at the discretion of the Head of Department.		
Department of Materials Science and Metallurgical Engineering		
SA Iron and Steel Institute Prize (SAISI Prize)	SAISI	For the best finalist in Metallurgical Engineering over four years of study (R10 000)
Prestige Award of the SA Institute of Mining and Metallurgy	SA Institute of Mining and Metallurgy	For the best achievement in the final year in Metallurgical Engineering (R2 000)
Kumba Prize	Kumba Resources	For the best achievement in the third year in Metallurgical Engineering (R2 000)
Arcelor Mittal Prize	Arcelor Mittal	For the best achievement in the second year in Metallurgical Engineering (R2 000).
Department of Materials Science and Metallurgical Engineering Prize	UP Dept. of Materials Science and Metallurgical Engineering	For the best achievement in the first year in Metallurgical Engineering (R2 000)
Department of Materials Science and Metallurgical Engineering Project Prize	UP Dept. of Materials Science and Metallurgical Engineering	For the best achievement in the final-year project in Metallurgical Engineering (R3 000)

Name	Donor	Award
Vesuvius SA Prize	Vesuvius SA	For the best student in Refractory Materials NVM321 (R1 000)
Hatch Africa Prize	Hatch Africa	For the best student in Process Metallurgy and Control NPB 411 (R1 500)
Department of Mining Engineering		
Prestige Award of the SA Institute of Mining and Metallurgy	SA Institute of Mining and Metallurgy	For the best achievement in the final year in Mining Engineering (R2 000)
Medal and Prize of the UP Mining Alumni Society	UP Mining Alumni Society	Medal plus R1000 for the best achievement in Mine Design 421
Mine Ventilation Society of South Africa Prize	Mine Ventilation Society of SA	For the best achievement in Mine Environment Engineering 410 (R400)
SANIRE Prize for Rock Mechanics	The SA Na-tional Group on Rock Mechanics	For the most outstanding achievement in Strata Control 410 (R500)
Mine Managers' Association of SA Prize	Mine Mana-gers' Asso-ciation of SA	For the best achievement in the second year of study (R500)
Sasol Prize	Sasol Ltd	Best academic student taking the full complement of first-year modules (floating trophy and cash prize)
Sasol Prize	Sasol Ltd	Best academic student taking the full complement of second-year modules (floating trophy and cash prize)
Sasol Prize	Sasol Ltd	Best academic student taking the full complement of third-year modules (floating trophy and cash prize)
MOVUP & De Villiers Prize	UP Mining Alumni Society	For the best student in Geology in the third year of study (Book prize of R500)

The Afrikaans text of this publication is the official version and will be given precedence in the interpretation of the content.