

University Rules and Syllabuses

for

Degrees and Diplomas

offered in the

Faculty of Engineering and the Built
Environment

for the 2022 Academic Year

All correspondence should be addressed, as far as is possible, directly to the relevant person or school.



UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG



Official address

The Faculty Registrar
Faculty of Engineering and the
Built Environment
University of the
Witwatersrand, Johannesburg
Private Bag 3
Wits, 2050

facultyregistrar.ebe@wits.ac.za

(+ 27) 011 717 7007

www.wits.ac.za/ebe

This handbook is a series of 9 handbooks produced by the Communications and Publications Unit, Wits University in 2020.

Contents

General Rules for the Faculty of Engineering and the Built Environment

Introduction	10
G1 Definitions	10
G2 Powers of the University	12
G3 Application of Rules	13
G4 Admission	13
4.1 Application for admission	13
4.2 Medical fitness	13
4.3 Discretion of the Senate to admit	13
4.4 Proficiency in English	14
4.5 Faculty or qualification-specific requirements	14
4.6 Certificate of good conduct	14
4.7 Credits and exemptions	14
4.8 Credits for previous study	15
4.9 Admission to an undergraduate diploma, certificate, licentiate or other qualification	15
4.10 Admission to the degree of bachelor	16
4.11 Admission to a programme leading to a higher qualification	17
4.12 Admission of occasional students	18
4.13 Admission of study–abroad/ international occasional students	19
4.14 Admission – previously excluded students	19
G5 Registration	19
5.1 Registration and renewal of registration	19
5.2 Concurrent registration at other institutions or faculties or for other qualifications	19
5.3 Registration as a student prior to registration for a qualification	20
5.4 Late registration	20
5.5 Registration for twelve months for senior doctorate	20
5.6 Cancellation of registration due to ill health	20
5.7 Cancellation of registration as a result of unsatisfactory performance/progress	20
5.8 Change of registration	21
5.9 Cancellation of registration by student	21
5.10 Refusal of permission to register	21
G6 Attendance	21
6.1 Minimum Attendance	22
6.2 Failure to attend	22
6.3 Outside work, visits, tours, fieldwork, vacation employment, non-examined courses	22
6.4 Exemption from attendance	22
6.5 Attendance requirement for students for qualification	22
6.6 Limitation on the activity of a student for reasons of ill health	22
G7 Curricula	23
7.1 Senate approval of curriculum	23
7.2 Condonation of breach of rules	23
7.3 Restriction on choice of courses	23
7.4 Special curricula	23
7.5 Change of rules during a student’s registration	24
7.6 Study-abroad component/ foreign electives	24
7.7 Credits	24
7.8 Minimum requirements of study	24

	7.9	Withdrawal of, or refusal to grant credits and/or exemptions	25
	7.10	Sub-minimum rule	25
G8		Requirements for Award of Qualification	25
G9		Degree of Master	25
	9.1	General	25
	9.2	The programme of master proceeding by research	25
	9.3	Programme of master by research report and coursework	25
	9.4	Conditions for the conferment of the degree of master by research	26
	9.5	Supervision of full-time members of staff	26
	9.6	Abstract and style of Dissertation or Research Report	26
	9.7	Copies of Dissertation or Research Report	26
	9.8	Formal declaration	26
	9.9	Acknowledgement of conferment of degree if material is published	27
	9.10	Completion of all requirements for the degree of master	27
G10		Degree of Doctor of Philosophy	27
	10.1	Fulfilment of requirements for conferment of the degree of Doctor of Philosophy	27
	10.2	Supervision of full-time members of staff	27
	10.3	Copies of thesis	28
G11		Senior Doctorate	28
	11.1	Conditions for the conferment of the degree	28
	11.2	Notice of intention to apply for candidature	28
G12		Conversion of candidature for higher qualifications	28
	12.1	General	28
	12.2	Conversion from a programme leading to the degree of master by research to a programme leading to the degree of Doctor of Philosophy	29
	12.3	Conversion from a programme leading to a degree of master by coursework and research report to a programme leading to the degree of master by research	29
G13		Assessment	30
	13.1	General	30
	13.2	Examiners	30
	13.3	Eligibility for assessment	31
	13.4	Additional oral or other form of assessment	31
	13.5	Supplementary assessments	31
	13.6	Deferred assessments	31
	13.7	Re-assessment	32
	13.8	Absence from assessment	32
G14		Academic Progression	32
	14.1	Completion of courses prescribed for previous year of study	32
	14.2	Standard required to proceed	32
	14.3	Prerequisite non-credit bearing courses	33
	14.4	Special curricula for students who cannot proceed to the next year of study	33
	14.5	Re-attendance requirement for students who cannot proceed to the next year of study	33
G15		Results	33
	15.1	Publication of results	33
	15.2	Non-publication of results	33
G16		Conferment of qualification	33
	16.1	Congregation	33
	16.2	Issuing of a certificate	34

16.3	Endorsement of certificate	34
16.4	Non-conferment of qualification	34
16.5	Permission to complete qualification by obtaining credits elsewhere	34
G17	Conferment of Qualification with Distinction	34
G18	Honorary Degrees	34
G19	Intellectual Property	35
G20	Ethical Clearance	35

Senate Rules for the Faculty of Engineering and the Built Environment

1	Application of Rules	36
2	UNDERGRADUATE	36
2.1	Professional Degrees	36
2.1.1	Admission Rules	37
2.1.2	Curricula	41
2.1.3	Progression Rules	57
2.1.4	Exclusion Rules	60
2.2	General Degrees	60
2.2.1	Admission Rules	60
2.2.2	Curricula	61
2.2.3	Progression Rules	69
2.2.4	Exclusion Rules	71
2.3	Prerequisite and corequisite rules*	72
3	POSTGRADUATE	86
3.1	Diplomas	86
3.1.1	Admission Rules	86
3.1.2	Curricula	87
3.1.3	Progression Rules for Postgraduate Diploma in Property Development and Management	94
3.1.4	Completion Rules	95
3.2	General Degrees	95
3.2.1	Admission Rules	95
3.2.2	Curricula	96
3.3	Masters Degrees	98
3.3.1	Rules applicable to Masters	99
3.3.2	Admission Rules	100
3.3.3	Curricula	101
a)	Masters by Research	101
b)	Masters by Coursework and Research Report	102
3.3.4	Completion Rules	134
3.4	Conversion	136
3.5	Prerequisite and corequisite rules	137
3.6	Doctorates and Senior Doctorates	137
3.6.1	Admission Rules	137
3.6.2	Completion Rules	140

Outcomes for the Faculty of Engineering and the Built Environment

4.1	The Built Environment	143
4.1.1	Degrees of Bachelor	143
4.1.2	Degrees of Bachelor with Honours	148
4.1.3	Degrees of Master	154
4.1.4	Doctoral Degrees	170

4.1.5	Senior Doctoral Degrees	171
4.1.6	Diplomas	173
4.2	Engineering	174
4.2.1	Degrees of Bachelor	174
4.2.2	Degrees of Master	178
4.2.3	Doctoral Degree	181
4.2.4	Senior Doctoral degrees	182
4.2.5	Diplomas	183

Syllabuses for the Faculty of Engineering and the Built Environment	185-358
--	----------------

POPI Disclaimer

The University collects and processes certain personal information about students which enables the University to meet its contractual obligations with its students. The University is committed to protecting the student's privacy and recognises that it needs to comply with statutory requirements in collecting, processing and distributing of personal information and in performing its obligations, the University will comply with the provisions of the relevant data protection legislation.

List of acronyms

Acronym	Definition
YOS	Year of study
PT	Part time
FT	Full time
CPD	Continuing Professional Development



WITS
UNIVERSITY

100 1922
2022

HIERARCHY OF ACADEMIC GOVERNANCE

ACTS create the powers and responsibilities of entities by law.

STATUTES

define how and what the University does to give expression to the provisions of the Act, and further includes features that are particular to Wits, for example, not all universities have a role for the Convocation.

POLICIES define a plan of action determined by Council.

REGULATIONS are subordinate to Acts and they define orders and authoritative direction. **REGULATIONS** are a set of directions on how **RULES** should be put into effect.

RULES

are made by Council for all areas of operation other than academic matters. Senate approves academic **RULES**, which are endorsed by Council. A **RULE** defines the principle to which action or procedure conforms. **RULES** set out what may or may not be done within a particular area of administration. These Rules are reviewed and published in the University Calendar each year.

PROCEDURES set out the practical steps necessary to realise the object or purpose of Rules and Regulations.



Senate's rules for faculties of the university are subordinate to the General Rules. These Rules are reviewed and published in the University Calendar each year.

These standing orders are recommended by Faculty Board to Senate for approval.

These standing orders are recommended by the School to the Faculty Board for approval.

HIGHER EDUCATION ACT, ACT 101 OF 1997

AMENDED STATUTE OF THE UNIVERSITY OF THE WITWATERSBURG, JOHANNESBURG (2018)

POLICIES OF THE UNIVERSITY

GENERAL RULES OF THE UNIVERSITY

PROCEDURES

SENATE STANDING ORDERS OF THE UNIVERSITY

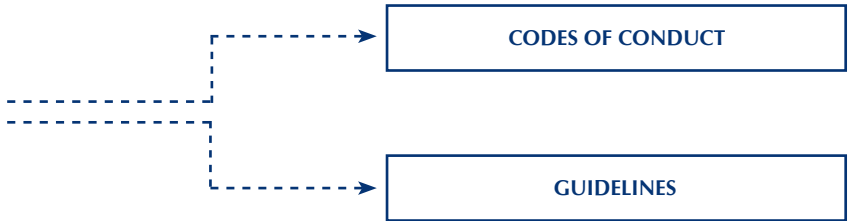
FACULTY STANDING ORDERS

SCHOOL STANDING ORDERS

Standing orders expand on rules and/or policies and govern the manner in which all business shall be conducted. Standing orders are a set of instructions on how to carry out a task.



‘University Community’ means all students and employees of the University, persons officially associated with the University, former students and alumni at the University, as well as invitees, visitors and guests.



Set out the preferred manner in which you carry out a process/procedures or course of action.

GENERAL RULES FOR THE FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

Introduction

The rules contained in this section are the General Rules of the *University* and apply to all *students*. There are also specific rules for each Faculty, which are subordinate to the General Rules. General Rules are defined by 'Rule G' and apply to all *students*.

On registering at this *University*, the *student* bears the responsibility of ensuring that s/he is familiar with the rules applicable to her/his registration. Ignorance of these rules will not be accepted as an excuse.

All Rules and Syllabuses are available online. Limited copies are also available in print format.

All words appearing in italics have been defined. Information presented in the shaded boxes, is intended for explanatory purposes only.

G1 Definitions

- 1.1 *Academic year* means the period determined by the *Senate* from time to time for any particular year of study for any particular *qualification*.
- 1.2 *Admission* means entry to a *course* or *qualification* unless it is indicated otherwise.
- 1.3 *Any university or any other university* means any university recognised by the *Senate* for the purpose under consideration.
- 1.4 *Applicant* means a person who has submitted an application in hard-copy or electronic format to become a *student* of the *University*.
- 1.5 *Assessment* means the process of judging learning and may have both a formative and/or summative nature.
- 1.6 *Auxiliary pass* (also referred to as ancillary pass or condoned pass, unless the contrary appears in the faculty rules) means a special type of condonation of a failing mark to a pass when no supplementary assessment is offered, so that the *course* will be included as a *credit* towards the *qualification* but the *student* may not proceed to a higher level *course* in that subject.
- 1.7 *Candidate/Postgraduate student* (see Rule G1.24) means a *student* registered for a *higher qualification* (see Rule G1.16).
- 1.8 *Corequisite course* is a course which must be taken with another course and is a requirement for credit in the other course.
- 1.9 *Course* means a component of teaching and learning activity, which may run for an entire academic year or a portion thereof, that is recognised in any of the faculty rules as a component of a *qualification*.
- 1.10 *Credit* means the recognition that is obtained when a *student* passes such *assessments* and complies with such conditions as the *Senate* may impose for the completion of each *course*. A *credit* towards a *qualification* may be granted to a *student* in respect of a *credit* obtained from another institution recognised by the *Senate* for this purpose or from another faculty within the *University*.

The plural includes the singular where the sense so suggests.

- 1.11 *Credit Accumulation and Transfer (CAT)* is the practice of accumulating credits from one or more cognate learning programmes in an institution, and the transfer of credits to be recognised towards a qualification/part-qualification in the same or a different institution to the satisfaction of Senate. This practice is subject to the rules published by the CHE and in conformance with the HEQFS requirements.
- 1.12 *Curriculum* means a *course* or combination of *courses* leading to a *qualification*.
- 1.13 *Dissertation* is the term reserved for an extended piece of written work that makes a contribution to the advancement of knowledge that may incorporate creative work or publications integral to the argument, and is submitted in fulfilment of the requirements for a degree of master by research.
- 1.14 *Examination and re-examination* mean a formal, compulsory, summative, scheduled assessment.
- 1.15 *Exemption* from a *course* means that the *Senate* has deemed a *student* to have a sufficient understanding of the subject matter of that *course* to warrant the *student* not having to complete the *course*. An *exemption* is not a *credit* but allows the *student* to proceed to the subsequent *level* in a particular *course*. The full number of *credits* required for a *qualification* is not affected by the granting of an *exemption*.
- 1.16 *Higher qualification* means a *qualification* which requires at least the attainment of a first degree, or equivalent recognised by the *Senate*, at entry level and includes a degree of Bachelor with Honours.
- 1.17 *Joint degrees* mean an undergraduate (Bachelors) or a *postgraduate* degree (Masters and PhD), jointly offered by the *University* and an external non-South African partner institution, recognised by the *Senate*. The student/candidate shall receive a single co-branded degree certificate representing work completed at the *University* and a partner institution.
- 1.18 *Matriculation* means the formal recognition by Umalusi prior to 2008 in terms of any law, of the capacity of a *student* to enter a university.

Umalusi is a council for quality assurance in the certification of qualifications in the general education and training band (Grades 0 to 9) and the further education and training band (Grades 10 to 12).

- 1.19 *National Senior Certificate (NSC)* means the formal recognition by Umalusi from 2008 in terms of any law, of the capacity of a *student* to enter a university.
- 1.20 *National Certificate (Vocational) [NC(V)]* means the formal recognition by Umalusi from 2009 in terms of any law, of the capacity of a vocational *student* to enter a university.
- 1.21 *Notional Hours of Learning* means the agreed estimate of the average learning time that it would take a student to meet the defined outcomes. It includes but is not limited to the consideration of contact time, research, completion of assignments, time spent in structured learning in the workplace, and individual learning.
- 1.22 *NQF credits* are *credits* recognised by the Higher Education Qualifications Sub-Framework (HEQSF) as a measure of the volume of learning required for a qualification, qualified as the number of notional study hours required for achieving the learning outcomes specified for a qualification.
- 1.23 *Occasional student* means a person who is registered at the *University* for any *course/s* for non-qualification purposes. An occasional *student* is deemed to be a *student* as defined in Rule G1.33 for all other purposes.
- 1.24 *Postgraduate student/Candidate* means a *student* who is registered for a *higher qualification* (see Rule G1.7).

- 1.25 *Prerequisite course* is a course for which *credit* must be obtained before being able to register for the subsequent course.
- 1.26 *Programme* is a course or set of courses or postgraduate research which may lead to a qualification.
- 1.27 *Qualification* includes any degree, diploma, certificate, licentiate, or any other educational attainment that is offered by the *University* as stipulated in its list of *qualifications*.
- 1.28 *Recognition of prior learning* means the taking into account of the previous learning and experience of the applicant by the *Senate* either for purposes of *admission* and/or for the granting of *exemption* or full or partial *credit* towards one or more courses.
- 1.29 *Research Report* is the term reserved for the written document which forms the research component of a degree of master by coursework and research report and which may include creative work or publications integral to the argument.
- 1.30 *Semester* is half an *academic year*.
- 1.31 *Senate* is defined in section 1 as read with section 28 of the Higher Education Act 101 of 1997 and is the body which governs the policies and procedures in respect of the teaching, learning, research and academic functions of the *University*. The *Senate* may delegate its powers except where expressly prohibited from doing so by the University Statute.

In many cases the powers of the Senate are, for practical purposes, delegated to and exercised by the deans of the faculties or, in specific instances their nominee/s.

- 1.32 *Short course* is a certified teaching and learning activity of less than 1200 notional study hours which does not, or does not directly, carry credit towards a qualification. With special permission of the *Senate*, short courses may carry *credit* towards a *qualification*. A short course student is not deemed to be a *student* as defined in Rule G1.33 but is still subject to the *University* rules, policies and procedures.
- 1.33 *Student* means any person registered at the *University* full-time or part-time for a degree, diploma, licentiate or certificate of the *University* or enrolled for any course or programme of instruction of the *University*, provided that a person so registered or enrolled who is also a full-time or part-time employee of the *University* is not a student for the purpose of membership of the Council or the *Senate*.
- 1.34 *Study-abroad component* means that part of a *curriculum* leading to a *qualification* which a *student* has been granted permission by the *Senate* to complete at an institution recognised by the *Senate* for this purpose, in a country other than South Africa.
- 1.35 *Teaching block* is a quarter of an *academic year*.
- 1.36 *Thesis* is the term reserved for an extended piece of writing based on research that makes an original and significant contribution to knowledge that may incorporate creative work or publications integral to the overall argument, and is submitted in fulfilment of the requirements for a doctor of philosophy qualification.
- 1.37 *University* means the University of the Witwatersrand, Johannesburg, unless the context indicates otherwise.

G2 Powers of the University

- 2.1 The *University* has the power in terms of section 77(3) of its Statute to confer, in any faculty, the degrees of bachelor, master and doctor, as well as to grant a diploma, certificate, licentiate or other *qualification* to any person who has satisfied such requirements as may be prescribed.

- 2.2 No *qualification*, other than an honorary degree, may be conferred by the *University* upon any person who has not attended the *University* as a *student* for such period, and satisfied such other requirements, as may be prescribed.
- 2.3 The *University* may confer, without attendance or examination, an honorary degree of master or doctor, in any faculty, upon any person who has rendered distinguished services in the advancement of arts, science, jurisprudence or other branches of learning, or who has otherwise rendered herself or himself worthy of such a qualification. The *University* has the power in terms of section 79(8) of its Statute to withdraw the conferment of any qualification.
- 2.4 The *University* provides higher education at or above level 5 of the National Qualification Framework as contemplated in the National Qualifications Framework Act, Act No 67 of 2008.
- 2.5 The *University* has the power in terms of its Statute and the Higher Education Act 101 of 1997 to determine the *admission* policy, the entrance requirements in respect of its *curricula*, the number of *students* who may be admitted for a particular *curriculum* or *course* and the manner of their selection and the minimum requirements for the readmission to a *curriculum* leading to a *qualification* in a faculty of the *University*. The *University* has the power to refuse readmission to a *student* who fails to satisfy such minimum requirements for readmission.
- 2.6 The *University* reserves the right not to offer a particular *course* or *qualification* notwithstanding that such *course* or *qualification* appears in the rules of a faculty.

G3 Application of Rules

- 3.1 These rules apply to all *students* who register for the first time in 2022 and to all *students* who were registered before 2022 unless for compelling reasons the *Senate* determines otherwise in a particular case, in which event such a *student* may proceed in terms of the rules under which s/he was last registered, or in terms of amendments to these rules, or in terms of a special *curriculum* laid down for her/him by the *Senate* subject to the provisions of Rule G7.
- 3.2 Where a right of appeal or review exists any *student*, who is the subject of an adverse decision must be informed by the member of the academic or administrative staff who conveys the decision of that right and of the procedure to be followed.

G4 Admission

4.1 Application for admission

A person who wishes to be admitted as a *student* of the *University* must apply in hard- copy or electronic format on the *University's* application form submitting evidence of her/his academic and general *qualifications*. In the case of application for *admission* to a *programme* leading to a higher *qualification* the *applicant* may be required to indicate the line of research s/he wishes to pursue.

4.2 Medical fitness

In respect of certain *courses* or *qualifications* an *applicant* may be required to demonstrate mental and/or physical fitness and may not be admitted to such *course* or *qualification* if s/he does not so demonstrate to the satisfaction of the *Senate*.

4.3 Discretion of the Senate to admit

Notwithstanding anything contained in the Rules regarding the minimum requirements for *admission*, the *Senate* may on good cause admit or refuse to admit any *student* to any year of study.

4.4 Proficiency in English

- 4.4.1** All *applicants for admission* (with the exception of those referred to in Rule G4.4.2) to any *curriculum* leading to a *qualification* must have passed English as a first or second language (higher grade) at *matriculation* or passed English home language or first additional language in the NSC or NC(V) or at a level considered equivalent by the *Senate* or deemed to be equivalent by legislation.
- 4.4.2** Immigrants of less than five years' residence in South Africa who have passed English at the standard grade at *matriculation* or who have passed English in the NSC or NC(V) will be considered for *admission*.
- 4.4.3** Notwithstanding Rule G4.4.1 and Rule G4.4.2, the *Senate* recognises the International English Language Testing System (IELTS) with a minimum test score of seven (7) or the Cambridge English Language Assessment (CAE) with a minimum of 185 points to be proficient for admission. In exceptional cases, the Test of English as a Foreign Language (TOEFL) may be recognised by the University with a minimum test score of 600 for *admission*.

A pass in English at the General Certificate of Secondary Education (GCSE), the International General Certificate of Secondary Education (IGCSE), or the General Certificate of Education (GCE) Ordinary level is considered equivalent to a pass in English at NSC or NC(V) level or at the higher grade at matriculation level.

4.5 Faculty or qualification-specific requirements

In addition to satisfying the minimum *admission* requirements of the *University*, an *applicant* must satisfy any additional requirements of the faculty to which s/he seeks *admission*.

4.6 Certificate of good conduct

A *student* who was registered at any other university, must upon application for *admission* to this *University*, submit a certificate of good conduct and an academic transcript issued by that university or those universities, which satisfies the *Senate* that s/he is a person of good standing.

4.7 Credits and exemptions

4.7.1 Credits

The *Senate* may grant a *student credit* in a *course* or *courses* once only, if s/he has completed:

- an equivalent *course* offered under a different curriculum, for the same *qualification* in the *University*;
- the same or equivalent *course* offered for another *qualification* in the *University* provided that the required attendance period at the *University* has been satisfied in terms of Rule G6.1; or
- an equivalent *course* offered in another university or institution recognised for this purpose by the *Senate* provided that the provisions of Rule G4.8 and Rule G7.9 are observed.
- an equivalent short *course* at this *University* recognised for this purpose by the *Senate* in terms of Rule G1.32 but such short *courses* shall not constitute more than 50 percent of the *credits* towards a *qualification*.

Such credits are acknowledged as part fulfilment of the requirements for a qualification and with permission of the Senate these courses may carry credit towards a qualification but shall not constitute more than 50 percent of the credits towards a qualification. See Rule G1.11.

4.7.2 Exemptions

On admission and subject to Rule G7.9 the *Senate* may grant a *student exemption* from a course or part of a course offered by the *University* where it has deemed a *student* to have a sufficient understanding of the subject matter to warrant the *student* not having to complete the course or part of the course. An *exemption* is not a *credit* but allows the *student* to proceed to the subsequent year of study in a particular course. The full number of *credits* required for a *qualification* is not affected by the granting of an *exemption*.

4.8 Credits for previous study

4.8.1 An *applicant* may be admitted to any curriculum leading to a *qualification* and this *University* may accept, as far as practicable, certificates of proficiency (*credits*) issued by another university or institution and periods of study as a matriculated *student* at another university or institution, provided that:

- a) the periods of attendance at this and any other institution are together not less than the completed period prescribed by this *University* for that *qualification*;
- b) s/he has at this *University*:
 - i) in the case of a first *qualification* for which the period of attendance is three or four *academic years*, attended for at least two *academic years* and has attended and completed at least half of the total number of NQF credits prescribed for the *qualification* including the final year course/courses in her/his major subject; or
 - ii) in the case of a first *qualification* for which the period of attendance is more than four years, attended for at least half the required period of attendance and completed at least half of the total number of *courses* prescribed for the *qualification*; or
 - iii) in the case of any other degree of bachelor offered after a first degree, attended for at least two *academic years*, except for the degree of Bachelor of Education (BEd), for which the period of attendance may be one *academic year*, and has attended and completed at least half of the total number of NQF credits prescribed for the degree.
 - iv) in the case of any postgraduate degree, attended and completed at least half of the total number of *courses* prescribed for the degree.
- c) s/he applies for such *credit* during or before the end of the first registration period.

4.8.2 A *student* may be granted entry to a *qualification* if s/he has completed a diploma with a minimum duration of three years at this *University* or another institution recognised by the *Senate* for this purpose. To allow for such entry into another *qualification* Umalusi must have granted complete or conditional exemption from the *matriculation* examination or must have formally recognised the capacity of the NSC or NC(V) *student* to enter a university. Such exemption or formal recognition by Umalusi must have been backdated to the commencement of the year in which *credit* for such diploma was first earned. *Credits* towards such a diploma may be accepted as part of the requirements for a *qualification* offered by the *University* provided that the *student* complies with Rule G4.8.1 (a), (b) i – iii and (c) above.

4.9 Admission to an undergraduate diploma, certificate, licentiate or other qualification

The *Senate* may, by resolution, determine the standard for admission to a programme leading to an undergraduate diploma, certificate, licentiate or other undergraduate *qualification* other than a degree. Different standards may be set for the different *qualifications*.

4.10 Admission to the degree of bachelor

4.10.1 National Senior Certificate/National Certificate (Vocational)/ Matriculation

The minimum requirement for admission to a programme leading to the degree of bachelor is:

- a *National Senior Certificate (NSC)* with the formal recognition by Umalusi in terms of any law, of the capacity of an applicant to enter a university for the degree of bachelor;
- a *National Certificate (Vocational) – NC(V)* with the formal recognition by Umalusi from 2009 in terms of any law, of the capacity of a vocational applicant to enter a university for the degree of bachelor;
- matriculation* in the form of a university entrance examination or a *matriculation* endorsement from Umalusi or the granting of complete or conditional *matriculation* exemption by the Matriculation Board of Universities South Africa (USAf).

The date of validity of the NSC, NC(V), matriculation certificate, matriculation endorsement, or certificate of exemption from the matriculation examination must precede 2 April of the academic year for which admission is sought, notwithstanding that the certificate may be issued at a later date.

4.10.2 Certificate of conditional exemption on recommendation of the Senate

Certificate of conditional exemption on recommendation of the *Senate*:

An *applicant* must be issued a certificate of conditional exemption by USAf if that *applicant*, in the opinion of the *Senate* has demonstrated, in a selection process approved by the *Senate*, that s/he is suitable for *admission* to the *University*. Where the *Senate* certifies that the holder of a certificate of conditional *exemption* issued in terms of this paragraph has completed the normal requirements of the *curriculum* for the first year of study of any qualification, USAf must issue a certificate of complete *exemption* to her/him, dated from the first day in January of the year in which the first degree credit was obtained. An applicant may be registered for a *course* under this rule only if places are available for that *course*. In the case of an applicant who has not qualified with an NSC or NC(V) for entry to a university, Rule G4.3 will apply.

4.10.3 Certificate of ordinary conditional exemption

An *applicant* who has been issued a conditional exemption from the *matriculation* examination and who has one outstanding requirement for complete exemption may be admitted to a programme leading to the degree of bachelor provided that s/he fulfils that outstanding requirement in the first year of study as prescribed by USAf. In the case of an *applicant* who has not qualified with an NSC or NC(V) for entry to a university, Rule G4.3 will apply.

4.10.4 Mature age conditional exemption

An *applicant* who has been issued a mature age conditional exemption from the *matriculation* examination by virtue of being over the age of 23 years or 45 years, as the case may be, may be admitted to a programme leading to the degree of bachelor on condition s/he fulfils the requirements of the undergraduate *qualification* within the period stipulated by the faculty concerned. Such fulfilment entitles the *applicant* to complete exemption from the *matriculation* examination.

For the purposes of mature age conditional exemption the USAf distinguishes between applicants aged 23 to 44 years and applicants of 45 years or more. Further details regarding mature age conditional exemption are available from USAf.

In the case of an *applicant* who has not qualified with an NSC or NC(V) for entry to a university, Rule G4.3 will apply.

4.10.5 Holder of a three-year diploma

An *applicant* who has passed school Grade 12, but who did not obtain a *matriculation* exemption, an NSC or an NC(V) to enter university, and who has completed a three- year diploma from a university, university of technology, teachers' training college, nursing college or a franchised or associated technical or community college recognised by the *Senate* for this purpose may be admitted to a programme leading to the degree of bachelor on condition that s/he fulfils the requirements of the undergraduate *qualification* within the period stipulated by the faculty concerned. Such fulfilment entitles the *applicant* to complete exemption from *matriculation*, the NSC or the NC(V).

4.10.6 Immigrant conditional exemption

Subject to Rule G4.4, a person who has resided in South Africa for less than five years and who has been issued with a conditional *matriculation* exemption by reason of not having passed a second language at higher grade in the school-leaving examination at a South African school, may be admitted to a programme leading to the degree of bachelor, on condition that s/he completes a second language *course* at higher grade or NSC or NC(V) or university level within the period stipulated by the faculty concerned. The *qualification* cannot be awarded until this condition has been fulfilled.

4.10.7 Foreign conditional exemption

An *applicant* from a foreign country who has been issued a conditional exemption from the *matriculation* examination by USAf may be admitted to a programme leading to the degree of bachelor on condition that s/he fulfils the requirements of the undergraduate *qualification* within the period stipulated by the faculty concerned. Such fulfilment entitles the *applicant* to complete exemption from the *matriculation* examination. In the case of a foreign *applicant* who has not qualified with an NSC or NC(V) for entry to a university, Rule G4.3 will apply.

4.11 Admission to a programme leading to a higher qualification

4.11.1 General requirement for admission to a programme leading to a higher qualification

For *admission* to a programme leading to a *higher qualification* the *Senate* must be satisfied that the *candidate* is qualified at an appropriate standard to undertake the proposed line of study or research or both.

4.11.2 Admission to a programme leading to a degree of bachelor with honours

Subject to Rule G4.11.6, a graduate in an area of study which the *Senate* considers appropriate of this or another university recognised by the *Senate* for this purpose may be admitted to a *programme* leading to the degree of bachelor with honours. However, in a case considered by it to be exceptional, the *Senate* may admit a person who has not satisfied all the requirements for the degree of bachelor, and in such a case the degree of bachelor with honours will not be made until the requirements for the degree of bachelor have been satisfied.

4.11.3 Admission to a postgraduate diploma or certificate

Subject to Rule G4.11.6, a graduate in an area of study which the *Senate* considers appropriate of this or another university recognised by the *Senate* for this purpose may be admitted to a programme leading to a postgraduate diploma or certificate. However, in a case considered by it to be exceptional, the *Senate* may admit as a *student* a person who has not satisfied all the requirements for the degree of bachelor, and in such a case the award of the postgraduate diploma or certificate will not be made until the requirements for the degree of bachelor have been satisfied.

4.11.4 Admission to a programme leading to the degree of master

Subject to Rule G4.11.6, a graduate of this or another university recognised by the *Senate* for this purpose may be admitted to a programme leading to the degree of master if s/he holds a *qualification* in a field considered by the *Senate* to be appropriate and which can normally only be taken over not less than four years of full-time study; or if s/he holds more than one *qualification* both or all of which are considered by the *Senate* to be in an appropriate field, and for which the combined number of years of full-time study is not less than four years. The *Senate* may require an applicant for registration for a programme leading to the degree of master to attend such courses or pass such examinations, oral or written or both, as it deems necessary before admitting her/him as a *candidate* for the *qualification*.

4.11.5 Admission to a programme leading to the degree of Doctor of Philosophy

Subject to Rule G4.11.6, a holder of a degree of master in an appropriate field from this or any other university recognised by the *Senate* for this purpose may be admitted to a programme leading to the degree of Doctor of Philosophy.

4.11.6 Overriding criteria for admission to a programme leading to the award of a higher qualification

Notwithstanding the criteria specified in Rule G4.11.2 to Rule G4.11.5 above, a person who has demonstrated a level of competence to the *Senate's* satisfaction by virtue of examples of research, writings, experience, professional standing or reputation or other attainments or *qualifications* in the discipline or cognate field may be admitted as a *candidate* to a higher *qualification*.

4.11.7 Admission to candidature for a senior doctorate

Any person may be admitted as a *candidate* for the degree of doctor if the *Senate* is satisfied, after consulting with an ad hoc committee of the faculty board concerned which has been convened to peruse the published work submitted, that, on the face of it, a case exists for admitting the *candidate*.

The following qualifications are senior doctorates:

Doctor of Architecture, Doctor of Commerce, Doctor of Economic Science, Doctor of Education, Doctor of Engineering, Doctor of Laws, Doctor of Literature, Doctor of Music, Doctor of Science, Doctor of Science in Architecture, Doctor of Science in Building, Doctor of Science in Business Administration, Doctor of Science in Dentistry, Doctor of Science in Engineering, Doctor of Science in Medicine, Doctor of Science in Quantity Surveying, Doctor of Science in Town and Regional Planning, Doctor of Town and Regional Planning.

4.12 Admission of occasional students

A person, whether matriculated or not, may be permitted by the *Senate* to register for *courses* outside a recognised *curriculum* subject to such requirements and conditions as may be determined by the *Senate*. However, any such courses may not subsequently be granted as *credits* towards a degree unless the *student* had matriculated before commencing them. A *student* seeking credit towards a *qualification* in respect of a *course* taken for non-qualification purposes at this *University* or another institution must satisfy the *Senate* that:

- a) s/he is eligible for *admission* to the *curriculum* leading to the *qualification*; and
- b) the validity of the *credit/s* has not lapsed.

4.13 Admission of study–abroad/ international occasional students

Students of an institution recognised by the *Senate* for this purpose may be admitted to courses for non-qualification purposes.

Where an exchange agreement with such an institution exists fees may be waived on the basis of reciprocity.

4.14 Admission – previously excluded students

The *Senate* may in exceptional circumstances consider the application of a *student* who was previously excluded from the *University*, for having failed to satisfy the minimum undergraduate degree requirements and exceeding the maximum time (N+2) for the completion of the degree. In such a case the *student* will have to demonstrate that if s/he is readmitted, s/he will be able to succeed and complete the degree.

G5 Registration

The last day for registration differs among faculties and programmes. It is the responsibility of the student to find out from the relevant faculty office when the last day of registration is for her/his programme and to register on or before that date.

5.1 Registration and renewal of registration

Except with the permission of the *Senate* no person may attend any course or proceed as a candidate for any qualification unless s/he is registered as a *student* of the *University* at the material time. Registration is renewable annually or on such shorter period as the *Senate* may determine.

Normally, an annual period of registration is from the date of registration in a particular year until the last day of registration in the first quarter of the subsequent year in the relevant faculty.

A student who registers in the first semester for first semester or full year course(s) may with the permission of Senate substitute such course(s) with an equivalent course(s) provided that they do so within the first two weeks of the first semester.

A student who registers in the first semester for a course(s) that commences in the second semester may with the permission of Senate substitute such course(s) with an equivalent course(s) provided that they do so within the first two weeks of the second semester.

5.2 Concurrent registration at other institutions or faculties or for other qualifications

A person who is registered as a *student* for any qualification may not be registered as a *student* for any other qualification or at any other faculty of the *University* or at any other tertiary education institution except with the approval of the *Senate* normally given in advance. Such approval will only be granted in circumstances considered exceptional by the *Senate*.

5.3 Registration as a student prior to registration for a qualification

The *Senate* may permit or require a person, before being registered for a *qualification*, to register as an occasional *student* and attend *courses* for such period and pass assessments at the prescribed standard in such *courses* as the *Senate* may determine in her/his case.

5.4 Late registration

Late registration, for which a fee may be charged, may be permitted by the *Senate* only in exceptional circumstances.

5.5 Registration for twelve months for senior doctorate

A *candidate* for a senior doctorate must be registered as a *student* of the *University* for at least twelve months before the *qualification* may be conferred.

5.6 Cancellation of registration due to ill health

5.6.1 An *applicant* for registration in the first or any subsequent year of study may be required to satisfy the Vice-Chancellor that s/he is physically and mentally fit to carry out the work involved in that or any subsequent year of study, and may for this purpose be required to present herself/himself for, and submit to, any medical examination that the Vice-Chancellor may require in her/his case.

5.6.2 The Vice-Chancellor may suspend the registration of any *student* if s/he is satisfied that this step is warranted because of the *student's* physical or mental ill health. An appeal against such suspension may be made to the Council.

5.6.3 The Council may cancel the registration of any *student* because of her/his physical or mental ill health if it is satisfied after giving the student a proper opportunity to make representations (as defined in the Administration of Justice Amendment Act 53 of 2002), that this step is warranted.

5.7 Cancellation of registration as a result of unsatisfactory performance/progress

5.7.1 The *Senate* may cancel the registration of an undergraduate *student* in one or more of the *courses* for which that *student* is registered in that year, if in the opinion of the *Senate* the *student's* progress is unsatisfactory or if the academic achievement of the *student* is such that s/he will not at the end of the year obtain *credit* in such *course* or *courses*. For this rule to be invoked, the Head of School must ensure the criteria have been published in advance by which progress and/or academic achievement will be judged as the case may be. An appeal against such cancellation may be made in the first instance to the relevant Head of School. If the Head of School is unwilling to reverse her/his original decision, s/he shall forthwith place the *student's* representations and his/her own written comments before the Dean for a decision. In exceptional cases, the Dean may set up an appeal committee composed of two senior faculty members (one from the school concerned) nominated by her/him. The decision of the Dean or the appeal committee, as the case may be, shall be final. Fee implications associated with the cancellation of registrations are outlined in the Schedule of Fees books.

5.7.2 The *Senate* may cancel the registration of an undergraduate *student* in the *qualification* for which that *student* is registered in that year and in the opinion of the *Senate* the *student's* progress is unsatisfactory or the *student* has not met the conditions that was stipulated for her/his readmission in that year of study.

- 5.7.3** The *Senate* may cancel the registration of a postgraduate *student* registered for a programme by research if a higher degrees committee (or equivalent), on the recommendation of the relevant supervisor(s) and head of school, has considered the research proposal and/or other milestones of the research of that *student* and has judged the research proposal or the progress towards the milestones to be academically unsatisfactory or, in material aspects, incomplete. The higher degrees committee may appoint a panel comprising one member of the higher degrees committee, the relevant supervisor and the relevant Head of School for the purpose of advising the higher degrees committee. Reasons must be given when such registration is cancelled and an appeal against such cancellation may be made to the Dean of the Faculty, who will then propose membership of an ad hoc committee to review the case. The three-person ad hoc committee will be chaired by the Dean. The Chairperson of the higher degrees committee; the Head of School and/or the Supervisor (or equivalent); may be in attendance.

If the ad hoc committee does not permit renewal of registration, the *student* has the right to submit a further appeal to the Deputy Vice-Chancellor (DVC): Research who may consult with the Dean. The decision of the DVC: Research acting on behalf of the Council, shall be final. Fee implications associated with the cancellation of registrations are outlined in the Schedule of Fees book.

- 5.7.4** The process set out in Rule G5.7.3 will also apply to a postgraduate *student* registered for a programme which includes coursework.

5.8 Change of registration

In exceptional circumstances, where a first-year *student* is adjudged by the *Senate* to be making inadequate progress and the criteria by which such judgment is made have been published in terms of Rule G5.7, the *student* may be permitted or required to alter her/his registration to a special *curriculum* for the same *qualification*.

5.9 Cancellation of registration by student

5.9.1 Date of cancellation of registration for a qualification

Unless in exceptional circumstances the *Senate* otherwise determines, a *student* who cancels her/his registration for a *qualification* less than one month prior to the commencement of the final *examination* session in which the *assessment* for that *qualification* are held, will be deemed to have failed in all the *courses* for which s/he was registered in that year, except for those *courses* which s/he has already completed.

5.9.2 Date of cancellation of registration in a particular course

Unless the *Senate* otherwise determines, a *student* may not cancel her/his registration for a particular *course* less than one month prior to the commencement date of the final *examination* session in which the *assessment* for that *course* is held.

5.10 Refusal of permission to register

A *student* who fails to complete a *course* may be refused permission by the *Senate* to register again for that *course* if *admission* to the *course* is limited or if s/he has registered more than once for that *course*.

G6 Attendance

6.1 Minimum Attendance

The minimum attendance for any programme shall be determined by the Faculty Rules in compliance with the HEQFS.

6.2 Failure to attend

Any *student* registered for any *course* who fails to fulfil the attendance requirements prescribed by the faculty for that *course* may be refused permission by the *Senate* to present herself/himself for assessment in that *course*.

6.3 Outside work, visits, tours, fieldwork, vacation employment, non-examined courses

The requirements for any *qualification* or *course* may include such work or attendance whether within or outside the *University* and during the academic year and/or vacation periods as the *Senate* may prescribe. A *student* is required to perform satisfactorily all duties required of her/him in this connection. Failure to comply with these requirements may result in the *student* being refused permission by the *Senate* to present herself/himself for *assessment*, to register for the subsequent year of study or any particular year of study thereafter or ineligibility for the conferment of the *qualification*.

6.4 Exemption from attendance

In exceptional circumstances where it is deemed appropriate, the *Senate* may excuse a *student* from attending all or part of a *course*.

6.5 Attendance requirement for students for qualification

Any *student* for whom attendance is not otherwise prescribed by the rules is required to attend at the *University* for such period and in such manner as may be determined by the *Senate*. The *Senate* may waive this requirement in exceptional circumstances.

6.6 Limitation on the activity of a student for reasons of ill health

6.6.1 The Vice-Chancellor is entitled to investigate the physical or mental health of any *student* where s/he considers it necessary in the interest of the *student* or in the interests of the *University*, to that end may require the *student* to obtain a medical report from or to submit to examination by a suitably qualified medical practitioner or psychologist acceptable to the Vice-Chancellor. The *University* is responsible for any costs incurred in the course of such investigation.

6.6.2 Whenever the Vice-Chancellor has reasonable grounds to believe that a *student* is or may become a danger to herself/himself or to any other person, or may cause damage to any premises occupied or under the control of the *University*, or may disrupt any of the activities or functions of the *University*, s/he may place limitations on the presence or activities of that *student* on *University* premises and the *student* is required to observe those limitations.

Without prejudice to her/his general powers under this rule, the Vice-Chancellor may prohibit the *student* from –

- a) entering the precincts of, or any specified part of the *University* including a *University* residence; and/or

- b) attending any lecture or any specified lectures, laboratory, or other classes or activity whether academic or otherwise.

Any action taken under this rule must be reported to the next meeting of Council or the Executive Committee of Council.

- 6.6.3** Unless in the opinion of the Vice-Chancellor the urgency of the case or the condition of the *student* concerned makes it inappropriate or impractical to do so, the Vice-Chancellor or any other officer of the University designated by the Vice-Chancellor, must interview the *student* concerned before any action is taken under Rule G6.6.2 above and afford her/him a reasonable opportunity to be heard.
- 6.6.4** Any limitation imposed on a *student* under Rule G6.6.2 above remains in force until the Vice-Chancellor is satisfied that it is no longer necessary. However, the *student* concerned is entitled at any time to make representations to the Vice-Chancellor or to apply to the Council to review any limitations imposed under Rule G6.6.2 above.
- 6.6.5** The Council may, at any time, investigate the matter and having considered any representations that may have been made by the Vice-Chancellor or the student concerned, may confirm, alter or set aside any limitation imposed under G6.6.2 above.

G7 Curricula

7.1 Senate approval of curriculum

A person may not be registered for a *curriculum* leading to a *qualification* in any year of study until her/his *curriculum* for that year has been approved by the *Senate*. An approved *curriculum* may only be amended with the consent of the *Senate*.

7.2 Condonation of breach of rules

The *Senate* may, with retrospective effect, condone any breach of the faculty rules governing a *curriculum* if it is satisfied that the *student* concerned was not at fault and would suffer undue hardship if the breach were not condoned.

7.3 Restriction on choice of courses

In terms of Rule G2.6 wherever the rules for a *qualification* provide for the selection of *courses* by a *student*, such selection may be limited by the timetable of classes, a restriction on the number of *students* to be registered for a particular *course* or insufficient *resources*.

7.4 Special curricula

The *Senate* may approve a special cognately consonant *curriculum* for a *student*:

- a) where it considers it necessary for that *student* to proceed on a *curriculum* which extends beyond the minimum period of full-time study. The maximum period of extension is stipulated in the faculty rules; or
- b) where it considers it necessary for that *student* to proceed on foundation and/or additional *courses* which do not contribute *credits* towards a *qualification*; or
- c) who has been granted *credits* or *exemptions* in terms of Rule G4.7; or
- d) who has interrupted her/his studies at the *University* prior to a change in the rules governing the *curriculum* or *qualification* for which s/he was registered or to whom no *curriculum* is currently applicable; or
- e) who has been permitted to proceed to a subsequent year of study without having obtained *credit* for all the *courses* prescribed for the previous year of study; or

- f) who has, in circumstances considered by the *Senate* to be exceptional, been able to give satisfactory evidence of her/his *qualifications* to proceed to a second or third level course in a subject; or
- g) who, in the opinion of the *Senate*, suffers or has suffered a disadvantage because of illness or physical disability or because of some other good and sufficient cause; or
- h) who has, in circumstances considered by the *Senate* to be exceptional, been able to give satisfactory evidence of her/his ability to complete the first course in a subject by part-time study; or
- i) in any other circumstances which it considers academically desirable or necessary. The granting of a special *curriculum* has been delegated by the *Senate* to the Dean of each faculty, or to the nominee/s of the Dean, in instances where the Dean reports such nomination/s and the period for which each such person will exercise this responsibility, to the Faculty Board.

7.5 Change of rules during a student's registration

If the rules governing a *qualification* are changed, a *student* who registered under the old rules and who has obtained sufficient *credits* to enable her/him to proceed to the next year of study in terms of those rules, may proceed on the old *curriculum* unless s/he elects to proceed on the new *curriculum*. However where there are, in the opinion of the *Senate*, compelling reasons for doing so, which may include failure in one or more courses, or where a *student* does not register for the next year of study in the ensuing academic year or where at her/his request, a *student* is permitted by the *Senate* to register in the ensuing year on a special *curriculum*, that *student* may be required by the *Senate* to proceed on new rules or on interim rules or on a special *curriculum* laid down for her/him by the *Senate*.

7.6 Study-abroad component/ foreign electives

A registered *student* who completes a *study-abroad component* approved by the *Senate* or, as part of an institutional exchange agreement, completes appropriate *credits* at an institution which is recognised by the *Senate* for this purpose in a country other than South Africa, earns *credits* as defined in the requirements for the *qualification*.

7.7 Credits

Subject to the rules pertaining to a particular *qualification* and any special restrictions on *credits* in the rules, a *student* obtains *credit* in any course that s/he successfully completes. However, even if a *student* obtains such *credit*, s/he may be refused permission to renew her/his registration if s/he fails to comply with the minimum requirements of study prescribed.

7.8 Minimum requirements of study

- 7.8.1 A *student* who does not meet the minimum requirements of study may be refused permission by the *Senate* to renew her/his registration. If, however, a *student* is permitted to renew her/his registration after having failed to satisfy the minimum requirements of study, s/he may be required to satisfy further conditions as the *Senate* may determine in her/his case.

The minimum requirements of study prescribed for students are set out in the faculty rules.

- 7.8.2 Save in exceptional circumstances, a *student* who fails to meet the minimum requirements of study after s/he has reached or exceeded the maximum time (N + 2) for the completion of the degree shall not be permitted by *Senate* to renew her/his study with the *University*.

Rule 7.8.2 will only apply to undergraduate programmes.

7.9 Withdrawal of, or refusal to grant credits and/or exemptions

The *Senate* may withdraw or refuse to grant *credits* and/or *exemptions* if, in the opinion of the *Senate*, the time which has elapsed between obtaining the *credit* or *exemption* and completion of the other requirements for the award of a *qualification* is excessive or is excessive in view of the nature of the subject.

Unless otherwise stipulated by the Dean of the Faculty, the shelf life of a course is four years.

7.10 Sub-minimum rule

Unless specified otherwise in a *course* outline, a *student* will not be allowed to obtain *credit* for a *course* unless s/he achieves:

- a) a final mark of at least 50 percent for that *course*; and
- b) a sub-minimum of 35 percent in each of the components of that *course* as well as in the summative assessment for that *course*.

Such a sub-minimum criterion applies only to components which contribute 25 percent or more towards a *course*, unless specified otherwise in the *course* outline.

Summative assessment in this instance is assessment that regulates the progression of *students* by awarding marks at the conclusion of a *course*.

G8 Requirements for Award of Qualification

In addition to the requirements of *admission*, registration, attendance and *assessment* applicable to the *qualification* for which a student is registered, such *student* must meet the requirements for the award of the *qualification* by obtaining *credit* in the *courses* set in each academic year and/or conducting research approved by the *Senate* and satisfying such further requirements as may be prescribed by the *Senate* and which are set out in the faculty rules.

G9 Degree of Master

9.1 General

The *Senate* may require a *candidate* for the degree of master as a condition of the conferment of the degree to attend such *courses* or pass such *examinations* (written or oral) as it deems necessary before conferring the *qualification*.

9.2 The programme of master proceeding by research

Where appropriate a faculty may offer a *programme* leading to the degree of master by advanced study and research normally under the guidance of a supervisor/s appointed by the *Senate*.

9.3 Programme of master by research report and coursework

Where appropriate a faculty may offer a *programme* leading to the degree of master by research report and coursework by attendance, completion of a curriculum approved by the *Senate* and submission of coursework and research report on an approved topic by the *Senate*.

9.4 Conditions for the conferment of the degree of master by research

A person who is admitted as a *candidate* for a degree of master by research must, after consultation with her or his supervisor if there is one, present for the approval of the *Senate* a *dissertation* on a subject approved by the *Senate*. The *dissertation* must, in the opinion of the *Senate*, constitute both an application of the methods of research and a contribution to the advancement of knowledge in the subject chosen.

Consistent with the definition of a *dissertation* in Rule G1.13, a *dissertation* will be an extended piece of written work which may incorporate creative work or publications.

The terms Dissertation and Research Report are defined in Rule G1.13 and G1.29 Further conditions for the conferment of the degree of master are set out in the faculty rules and the Senate Standing Orders for Higher Degrees.

9.5 Supervision of full-time members of staff

In circumstances considered by it to be exceptional the *Senate* may dispense with the requirement for supervision in the case of a *candidate* who holds an appointment as a member of the full-time academic staff of the *University* and has held such appointment for such period as is laid down in the faculty rules. In such a case the *Senate* must appoint an internal and external examiner.

9.6 Abstract and style of Dissertation or Research Report

The *Dissertation* or *Research Report* prescribed by the *Senate* must include an abstract and conform as far as possible to the style, length and format recommended in the authorised style guide obtainable from faculty offices.

9.7 Copies of Dissertation or Research Report

A candidate for the degree of master must submit for examination an electronic copy of her/his dissertation or research report via email or any other electronic platform designated by the faculty office. In exceptional circumstances the examiner may request a hard copy of the dissertation or research report. In such a case, the candidate will be required to provide a bound hard copy or copies, together with the electronic version. Copies must be in a format that, in the opinion of the *Senate*, is suitable for submission to the examiners.

Prior to graduation, a candidate must submit a final, corrected electronic copy of her/his dissertation or research report via email or any other electronic platform designated by the faculty office.

9.8 Formal declaration

Together with her/his *dissertation* or *research report*, a *candidate* must submit a formal declaration stating whether –

- it is her/his own unaided work or, if s/he has been assisted, what assistance s/he has received;
- the substance or any part of it has been submitted in the past or is being or is to be submitted for a qualification at any other university;
- the information used in the *dissertation* or *research report* has been obtained by her/him while employed by, or working under the aegis of, any person or organisation other than the *University*.

9.9 Acknowledgement of conferment of degree if material is published

A *candidate* upon whom a degree of master has been conferred by the *University* and who subsequently publishes or republishes her/his *dissertation* or *research report* in whole or in part, must indicate on the title page or in the preface or, if this is not appropriate, in a footnote, that such *Dissertation* or *Research Report* has been approved for that *qualification* by the *University*.

9.10 Completion of all requirements for the degree of master

Unless the *Senate* has granted an extension of time, a *candidate* who has not satisfied all the requirements for the degree of master including submission of a *research report*, if s/he is required to submit one, by the date stipulated in the faculty rules is deemed to have failed. If the *Senate* grants her/him such extension s/he is required to register for the new academic year.

G10 Degree of Doctor of Philosophy

10.1 Fulfilment of requirements for conferment of the degree of Doctor of Philosophy

When the research is completed a *candidate* must:

- a) present for the approval of the *Senate* a *thesis*, the research for which is normally conducted under the guidance of a supervisor/s, which must constitute in the opinion of the *Senate* a substantial contribution to the advancement of knowledge in the subject chosen, and which must be satisfactory as regards literary presentation;

The term thesis is defined in Rule G1.36. Further conditions for the conferment of the degree of Doctor of Philosophy are set out in the faculty rules and the Senate Standing Orders for Higher Degrees.

- b) furnish an abstract with each copy of the *thesis*;
- c) if required by the *Senate*, present herself/himself for such *assessment*, or such other requirements as the *Senate* may determine in respect of the subject of her/his *thesis*.

10.2 Supervision of full-time members of staff

In circumstances considered by it to be exceptional, the *Senate* may dispense with the requirement for supervision in the case of a *candidate* who holds an appointment as a member of the full-time academic staff of the *University* and has held such appointment for such period as is laid down in the faculty rules. In such a case, the *Senate* must appoint one internal and two external examiners.

10.3 Copies of thesis

Unless the faculty rules for the qualification require otherwise, a candidate for the degree of Doctor of Philosophy must submit for examination an electronic copy of her/his thesis via email or any other electronic platform designated by the faculty office. In exceptional circumstances, the examiner may request a hard copy of the thesis. In such a case, the candidate will be required to provide a bound copy of her/his thesis, together with the electronic version. The bound copies must be in a format that, in the opinion of the Senate, is suitable for submission to the examiners.

Prior to graduation, a candidate must submit a final, corrected electronic copy of her/his thesis via email or any other electronic platform designated by the faculty office.

The rules relating to formal declaration (Rule G9.8), acknowledgement of conferment of the *qualification*, (Rule G9.9) and completion of all requirements for the degree of master (Rule G9.10), apply with the appropriate changes.

G9.7, G10.3: A candidate for a higher degree is not entitled to the return of such copies.

G11 Senior Doctorate

11.1 Conditions for the conferment of the degree

A *candidate* for a senior doctorate must present for the approval of the *Senate* at least five copies of original published work, or original work accepted for publication, in a field approved by the *Senate*. Such work must, in the opinion of the *Senate*, constitute a distinguished contribution to the advancement of knowledge in that field.

11.2 Notice of intention to apply for candidature

A *candidate* must give notice in writing to the Registrar of her/his intention to present herself/himself as a *candidate* for the *qualification*, submitting at the same time the title and an outline of the proposed submission.

G12 Conversion of candidature for higher qualifications

12.1 General

Where the requirements for a higher qualification allow, a *candidate* may be permitted or required by *Senate* under conditions prescribed by it to convert her/his candidature from one higher *qualification* to another within the period of registration. Special conditions for conversion are specified in the faculty rules.

The conditions for conversion are generally applicable for existing *programmes* and *qualifications* prior to 2009, for new *programmes* or *qualifications*, i.e. those which have not existed before 2009, the conditions for conversion are subject to *Senate* discretion. On conferment of a converted higher *qualification*, the transcript will be endorsed to reflect the conversion.

Conditions for conversion may change in light of the Higher Education Qualifications Sub-Framework.

12.2 Conversion from a programme leading to the degree of master by research to a programme leading to the degree of Doctor of Philosophy

- a) A person who has been admitted as a *candidate* for the degree of master may, in exceptional circumstances, at her/his request and on the recommendation of the supervisor and of the Head of the School concerned, on the basis of work towards the *dissertation* be allowed, by permission of the *Senate*, to proceed instead to the degree of Doctor of Philosophy. Provided further that the degree of master shall NOT be conferred on her/him in the event of her/his–
 - i) withdrawing her/his candidature for the degree of Doctor of Philosophy;
 - or
 - ii) having her/his candidature for the degree of Doctor of Philosophy cancelled in terms Rule G5.7; or failing to satisfy the requirements for the degree of Doctor of Philosophy.
- b) A person who has completed the requirements for the degree of master, at her/his request and on the recommendation of the Head of the School concerned, may be permitted by the *Senate* not to have the qualification conferred on her/him, but to conduct, for not less than one academic year of further full-time study, or not less than two academic years of further part-time study, additional research for the degree of Doctor of Philosophy, which shall be a significant extension of the research already completed by her/him: Provided that the period of additional research may be waived or reduced in a case considered by the *Senate* to be exceptional. Provided further that the degree of master shall NOT be conferred on her/him in the event of her/his –
 - i) withdrawing her/his candidature for the degree of Doctor of Philosophy;
 - or
 - ii) having her/his candidature for the degree of Doctor of Philosophy cancelled in terms Rule G5.7; or
 - iii) failing to satisfy the requirements for the degree of Doctor of Philosophy.
- c) A person who is permitted to change her/his candidature in terms of (a) or (b) above will be deemed to have been admitted to candidature for the degree of Doctor of Philosophy at the date of her/his admission to candidature for the degree of master, or at such later date as the *Senate* may determine in her/his case, but will be subject, in all other respects, to the rules for the degree of Doctor of Philosophy and such other conditions as the *Senate* may determine in her/his case.

12.3 Conversion from a programme leading to a degree of master by coursework and research report to a programme leading to the degree of master by research

- a) A person who has been admitted as a candidate for the degree of master by coursework and *research report* may, in exceptional circumstances, at her/his request and on the recommendation of the supervisor and of the Head of the School concerned, on the basis of work towards the *research report* be allowed, by permission of the *Senate*, to proceed instead to the degree of master by research. Provided further that the degree of master by coursework and *research report* shall NOT be conferred on her/him in the event of her/his–

- i) withdrawing her/his candidature for the degree of master by research; or
 - ii) having her/his candidature for the degree of master by research cancelled in terms Rule G5.7; or
 - iii) failing to satisfy the requirements for the degree of master by research.
- b) A person who has completed the requirements for the degree of master by coursework and *research report*, at her/his request and on the recommendation of the Head of the School concerned, may be permitted by the *Senate* not to have the degree conferred on her/him, but to conduct, for not less than one academic year of further full-time study, or not less than two academic years of further part-time study, additional research for the degree of master by research, which shall be a significant extension of the research already completed by her/him: Provided that the period of additional research may be waived or reduced in a case considered by the *Senate* to be exceptional. Provided further that the degree of master by coursework and *Research Report* shall be conferred on her/him in the event of her/his –
 - i) withdrawing her/his candidature for the degree of master by research; or
 - ii) having her/his candidature for the degree of master by research cancelled in terms Rule G5.7; or
 - iii) failing to satisfy the requirements for the degree of master by research.
- c) A person who is permitted to change her/his candidature in terms of (a) or (b) above will be deemed to have been admitted to candidature for the degree of master by research at the date of her/his admission to candidature for the degree of master by coursework and *research report*, or at such later date as the *Senate* may determine in her/his case, but will be subject, in all other respects, to the rules for the degree of master by research and such other conditions as the *Senate* may determine in her/his case.

G13 Assessment

13.1 General

An *assessment* may be written, practical, electronic, clinical or oral, in project or assignment form or be any other piece of work or any combination thereof as may be specified by the *Senate*, provided that a *student's* overall *assessment* does not consist of an oral *assessment* alone, except if expressly determined as appropriate by the *Senate*. Such determination may not be delegated. In all cases the evaluation must be in a form that is suitable for objective *assessment* by an internal moderator or external examiner. In each case the School must make clear the extent and nature of the work to be assessed and the criteria to be used.

13.2 Examiners

- 13.2.1 At least one examiner for each *course* must be a member of the academic staff of the *University* who has taught the *students* in the *course* under *assessment* unless it is impracticable in any instance because of the death, dismissal, resignation, absence, illness or other incapacity of the member of staff concerned, or for some reason deemed by the *Senate* to be sufficient.
- 13.2.2 At least 50 percent of the *assessments* that contribute to the final marks for every *course* will be internally moderated and/or externally examined, provided that at least 30 percent of every *course* is externally examined.

- 13.2.3** An internal moderator is normally a member of the academic staff who may be from the same department or school or from another department or school but who has not been involved at all in teaching the *course* during the relevant *academic year*. Unless otherwise impracticable or with the approval of the Dean, an internal moderator should not be appointed to examine the same *course* for more than three consecutive years.
- 13.2.4** An external examiner is normally appointed from outside the *University*, preferably from another university, or in the case of professional disciplines, from among experienced members of the professions. In exceptional cases where these options are impracticable, a member of the academic staff may, with the permission of the Dean, be appointed as an external examiner but only if s/he has not been involved at all in teaching the *course* during the relevant *academic year*. Unless otherwise impracticable or with the approval of the Dean an external examiner should not be appointed to examine the same *course* for more than three consecutive years. There should be no reciprocity between external examiners from this and other institutions save in circumstances which the *Senate* deems exceptional.
- 13.2.5** An additional requirement with regard to examiners for the degree of Doctor of Philosophy is that the *Senate* must appoint three examiners of whom two must be external examiners as defined in Rule G13.2.4 above.

13.3 Eligibility for assessment

A *student* may be disqualified from presenting herself/himself for any *assessment* if s/he has not satisfied such requirements, including satisfactory participation in the work of the class, as may be prescribed by the *Senate*.

These requirements include, but are not limited to: attendance, assignments completed, tutorials participated in, practical experiments, clinical work, field work and outside work. It is incumbent on each student to ascertain from the head of school what is required to qualify for presentation for assessment for each course. Disqualification includes being refused permission to complete an assessment or receiving no marks for such assessment.

13.4 Additional oral or other form of assessment

The *Senate* may require a *student* to present herself/himself for an oral or other form of *assessment* if, on the marks obtained by her/him after prescribed *assessment/s*, s/he is, in the opinion of the *Senate*, on the borderline of the pass mark or the mark required for a particular class, as defined in the faculty or school standing orders. In such an event the marks obtained in such oral assessment are reported to the *Senate* in addition to the marks obtained in the prescribed *assessment/s*. The *Senate* must then determine the mark to be allocated.

13.5 Supplementary assessments

A *student* who has failed a *course* may be permitted by the *Senate* to present herself/himself for a supplementary *assessment* where such *assessment* is permitted by the rules of the faculty which teaches and examines the *course*, unless otherwise agreed by the faculties concerned. Supplementary *assessments* may only be deferred in circumstances considered by the *Senate* to be exceptional.

A supplementary assessment fee may be charged.

13.6 Deferred assessments

- 13.6.1** *Students* applying for a deferred examination must do so within three (3) working days after the date of the examination.

- 13.6.2** If the Dean of the faculty is satisfied that there is sufficient reason, s/he may permit a *student* to defer her/his *assessment/s*. The Dean will require the *student* to submit such evidence to support her/his case as the Dean considers necessary.

A Dean who permits a *student* to present herself/himself for a deferred *assessment* may require her/him to do so at such time and subject to such conditions as s/he considers fit and, in particular, may require the *student* to defer or to repeat (as the case may be) some or all her/his *assessments* (or some or all the *assessments* that s/he has not failed) in the year in respect of which her/his application is lodged.

- 13.6.3** A *student* who does not present herself/himself for a deferred *assessment* is not entitled or permitted to have the *assessment* further deferred unless there are, in the opinion of the *Senate*, exceptional grounds for permitting her/him to do so.

- 13.6.4** Unless in the opinion of the *Senate*, exceptional circumstances exist, a deferred *assessment*:

- a) in the first semester, must be completed not later than the first week of the third *teaching block*;
- b) in the second semester, must be completed before the commencement of the following *academic year*.

13.7 Re-assessment

Where a *student* has presented herself/himself for *assessment* and before the results or provisional or unconfirmed results of such *assessment* are published, the Dean of the faculty, after due consideration of the relevant factors, may permit a *student* to sit for *re-assessment* if at the time of the *assessment* owing to illness or her/his mental state, the *student* was unable to bring her/his judgment properly to bear on whether to apply for a deferred *assessment* in terms of Rule G13.6.1 above and if the Dean considers that the *student* would suffer hardship to an exceptional degree were s/he not allowed to do so.

13.8 Absence from assessment

Unless the *Senate* is satisfied that there was good and sufficient reason, a *student* who is absent from an *assessment*, in a *course* for which, in accordance with the relevant *curriculum*, s/he is required, permitted or entitled to present herself/himself, fails that *course*.

G14 Academic Progression

14.1 Completion of courses prescribed for previous year of study

Except as provided in the rules for any *qualification* or by permission of the *Senate*, a *student* may not be admitted to a year of study until s/he has completed the *courses* prescribed for any preceding year of study and satisfied such further requirements, if any, as are prescribed by the rules.

14.2 Standard required to proceed

A *student* may not include in her/his *curriculum* any *course* at a subsequent level unless s/he has attained in that *course* at the preceding level such standard as is considered by the *Senate* to warrant her/his admission to the *course* at the subsequent level and has satisfied the prerequisites for that *course* as determined by the *Senate* from time to time.

14.3 Prerequisite non-credit bearing courses

Where a *student* is required to attend a *course* which does not constitute a *credit* towards the *qualification* for which s/he is registered or to perform any other requirement prescribed for any particular year of study for any *qualification*, her/him failure to attend such *course* or to perform such other requirement may result in her/him being refused permission by the *Senate* to register for the subsequent year of study or any particular year of study thereafter.

14.4 Special curricula for students who cannot proceed to the next year of study

A *student* who has obtained *credit* in some of the *courses* prescribed for any year of study but who may not in terms of the rules proceed to the following year of study and who has not been excluded in terms of the faculty rules for progression, may be permitted or required by the *Senate* to proceed on a special *curriculum*. In addition to the *courses* being repeated the student may be permitted to include in her/his *curriculum* a *course* or *courses* prescribed for the next year of study and/or such *course* as may enrich the content of her/his *curriculum*.

14.5 Re-attendance requirement for students who cannot proceed to the next year of study

A *student* who is not permitted by the *Senate* to proceed to the subsequent year of study or to include in her/his *curriculum* for the following academic year a further *course* in a subject in which s/he has obtained *credit*, may be required by the *Senate* to re-attend and perform to the satisfaction of the *Senate* the work of the class prescribed for such a repeated *course*, failing which s/he may be refused permission to register for the subsequent year of study or any particular year of study thereafter.

G15 Results

15.1 Publication of results

The final mark obtained by a *student* in a *course* may be published either by way of a percentage mark or as a result decision except where the *Senate* has, in the case of some supplementary *assessments*, ruled otherwise.

15.2 Non-publication of results

The final marks obtained by a *student* will not be published and a *qualification* will not be conferred on a *student* unless and until –

- s/he has paid all outstanding fees, levies, disbursements, fines and any other monies lawfully owing to the *University*;
- any disciplinary proceedings, pending or incomplete, have been completed; and
- there has been compliance with any order made against the student as a consequence of any disciplinary proceedings.

G16 Conferment of qualification

16.1 Congregation

Qualifications must be conferred by the *University* at a meeting of the Congregation of the *University* convened for this purpose.

16.2 Issuing of a certificate

Degrees are conferred and Diplomas are granted at a *University* Graduation ceremony. A degree or diploma certificate will not be issued to a *student/candidate* prior to her/his name appearing in the official graduation programme.

16.3 Endorsement of certificate

Where a *qualification* is conferred or granted in a specific field, option or branch, the *Senate* may determine that the certificate attesting to such conferment or granting will bear a statement specifying that field, option or branch. The *Senate* may determine that where a person who has been granted such a certificate has satisfied the requirements for another field, option or branch, the original certificate be endorsed to reflect this fact.

16.4 Non-conferment of qualification

A *student* who otherwise qualifies for the conferment of a *qualification* may be deemed not to have done so unless and until –

- a) the *student* has paid all outstanding fees, levies, disbursements, fines and any other monies lawfully owing to the *University*;
- b) any disciplinary proceedings, pending or incomplete, have been completed;
- c) any order made against the *student* as a consequence of any disciplinary proceedings has been complied with; and
- d) in the case of the conversion from one higher *qualification* to another s/he has surrendered the certificate in respect of the former higher *qualification*. Where such surrender is impossible the *Senate* may permit the conferment of the *qualification*.

16.5 Permission to complete qualification by obtaining credits elsewhere

The *Senate* may, if it considers fit, permit a *student* who has only one or two, or, in a case considered by it to be exceptional, three *courses* or such number of *courses* as does not exceed 30 per cent of the total number of prescribed *courses* outstanding for a *qualification* and who satisfies the *Senate* that, by reason of a change of residence, or for some other good and sufficient cause, s/he is unable to continue attending at the *University*, to complete such *course* or *courses* at another university or at an institution recognised for this purpose by the *Senate* within or outside the Republic of South Africa.

The policy of the faculties on this issue is set out in the standing orders of each faculty.

G17 Conferment of Qualification with Distinction

The *qualification* is awarded with distinction or with distinction in a particular *course* to a *student* who has obtained the standard laid down by the *Senate* for that purpose.

G18 Honorary Degrees

- 18.1 A proposal to confer an honorary degree may be made either by a member of the Council or of the *Senate* and must be seconded by another member of either of these structures.

- 18.2 The proposal must be communicated in writing to the University Registrar.
- 18.3 The proposal must be accompanied by a statement setting out the reasons for making it.
- 18.4 A resolution to confer an honorary degree must be passed in the Council and in the Senate by an absolute majority of the members of each structure voting by secret postal ballot.
- 18.5 A person who sits on both structures is entitled to vote in each election.

G19 Intellectual Property

Students are advised to refer to the University Policy on Intellectual Property.

- 19.1 Any owner's right to intellectual property in any *thesis, dissertation, Research Report* or any other work is normally subject to the right of the *University* to make a reproduction of it or parts of it in any medium for a person or institution requiring it for study or research, provided that not more than one copy is supplied to that person or institution.
- 19.2 Where research includes a patentable invention, the *University* may keep the research confidential for a reasonable period if specifically requested to do so.
- 19.3 Where confidentiality has been agreed in advance the *University* must keep the research confidential for the period agreed.
- 19.4 Subject to 19.2 and 19.3 the *University* may distribute abstracts or summaries of any *thesis, dissertation, research report* or any other work for publication in indexing and bibliographic periodicals considered by the *University* to be appropriate.

G20 Ethical Clearance

Students who propose to conduct research of any kind on human or animal subjects must apply for ethical clearance from the appropriate *University's* Ethics Committee/s

SENATE RULES FOR THE FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

These Rules are subordinate to and should be read in conjunction with the General Rules. The Rules for degrees and diplomas published here are subject to change. They reflect the Rules and Regulations of the University as at 31 July 2021 but may be amended prior to the commencement of the 2022 *academic year*.

1 Application of Rules

See Rule G3.

2 UNDERGRADUATE

Unless otherwise permitted by the *Senate*, a *student* who is admitted for the first time to any year of study for the degrees of BSc (Eng), BEngSci, BAS, BSc (Urban and Regional Planning), and BSc (Construction Studies) shall be required to produce valid certificates in both First Aid and Occupational Health and Safety granted by authorities recognised for this purpose by the *Senate*. The onus shall be on the *student* to ensure the validity of such certificates throughout her/his registration for the degree.

2.1 Professional Degrees

Qualification Name		Programme Code	NQF Exit Level
Bachelor of Science in Engineering (in various branches) – BSc (Eng)	Aeronautical Engineering*	EFA06	8
	Chemical Engineering**	EFA00	8
	Civil Engineering	EFA01	8
	Electrical Engineering***	EFA03	8
	Industrial Engineering*	EFA07	8
	Mechanical Engineering*	EFA05	8
	Metallurgy and Materials Engineering**	EFA08	8
	Mining Engineering	EFA09	8

*The *curricula* for these *programmes* are offered by the School of Mechanical, Industrial and Aeronautical Engineering.

**The *curricula* for these *programmes* are offered by the School of Chemical and Metallurgical Engineering.

***An optional *curriculum* is provided in the following branch from 3rd year of study: *Electrical Engineering: Information Engineering (EFA04) NQF level 8*

2.1.1 Admission Rules

2.1.1.1 Minimum requirements for admission – National Senior Certificate (NSC)

1) BSc (Eng) (all branches)

A pass in English Home Language or first additional language at the NSC Scale of Achievement level 5; a pass in Physical Science at the NSC Scale of Achievement level 5; and a pass in Mathematics at the NSC Scale of Achievement level 5.

A *student* who has successfully completed courses in Chemistry and Physics at a university or other institution recognised by the *Senate* for this purpose may be deemed by the *Senate* to have obtained a pass in Physical Science.

Compliance with minimum requirements does not guarantee admission

2.1.1.2 Minimum requirements for admission – non NSC matriculants

1) BSc (Eng) (all branches)

A pass in Physical Science at the Higher Grade or a standard of a minimum of 60 percent at the Standard Grade.

A pass in both Mathematics and Physical Science at the Higher Grade. In exceptional circumstances, the *Senate* may accept a standard of a minimum of 60 percent in either or both of these subjects at the Standard Grade. A *student* who has successfully completed courses in Chemistry and Physics at a university or other institution recognised by the *Senate* for this purpose may be deemed by the *Senate* to have obtained a pass in Physical Science at the Higher Grade.

NC(V) - Besides meeting the *University's* requirements an *applicant* who holds an NC(V) will be interviewed by the Dean, Assistant Dean and relevant Head of School.

2.1.1.3 Change of registration

1) Bachelor of Engineering Science (Biomedical Engineering) to Bachelor of Science in Engineering in the branch of Electrical Engineering

A *student* may change her/his registration to the *qualification* of Bachelor of Science in Engineering in the branch of Electrical Engineering after successfully completing either the first or second year of the Bachelor of Engineering Science in Biomedical Engineering. The year into which the *student* will be admitted is as follows:

second year of the Bachelor of Science in Engineering in the branch of Electrical Engineering if s/he has successfully completed the first year of the Bachelor of Engineering Science in Biomedical Engineering; or

third year of the Bachelor of Science in Engineering in the branch of Electrical Engineering if s/he has successfully completed the second year of the Bachelor of Engineering Science in Biomedical Engineering.

Change of registration after completion of first or second year of the Bachelor of Engineering Science (Biomedical Engineering) is subject to approval by the Faculty after consultation with the Head of the School of Electrical and Information Engineering.

A person who has completed the Bachelor of Engineering Science (Biomedical Engineering) degree may be admitted to the third year of study for the BSc (Eng) in the branch of Electrical Engineering.

In the event that a *student* changes direction as described in this rule, s/he may select either the information option or the standard electrical engineering option of the qualification.

2) Change of registration from Bachelor of Science (Applied Computing) to Bachelor of Science in Engineering in the branch of Electrical Engineering (Information Engineering)

A person who has completed the BSc Applied Computing degree may be admitted to the third year of study for the BSc (Eng) in the branch of Electrical Engineering (Information Engineering).

- 3) **Change of registration from Bachelor of Engineering Science (Digital Arts) to Bachelor of Science in Engineering in the branch of Electrical Engineering – (Information Engineering option)**

A student may change her/his registration to the qualification of Bachelor of Science in Engineering in the branch of Electrical Engineering after successfully completing either the first or second year of the Bachelor of Engineering Science in the field of Digital Art. The student will be admitted to:

- 1) the second year of the Bachelor of Science in Engineering in the branch of Electrical Engineering if s/he has successfully completed the first year of the Bachelor of Engineering Science in the field of Digital Art; or
- 2) the third year of the Bachelor of Science in Engineering in the branch of Electrical Engineering in the field of Information Engineering, if s/he has successfully completed the second year of the Bachelor of Engineering Science in the field of Digital Art.

This change of registration is subject to approval by the Faculty after consultation with the Head of the School of Electrical and Information Engineering.

2.1.1.4 Admission of technikon/university of technology diplomates to the undergraduate qualifications in the Faculty

A person who has completed an appropriate S4 (i.e. four semesters of academic education at a technikon/university of technology), or equivalent, and has attained in this *qualification* such standard as the Senate may require for this purpose, may be admitted to the second year of study in any of the programmes offered by the Faculty excluding Bachelor of Architectural Studies.

2.1.1.5 Admission of BSc graduates to Bachelor of Science in Engineering in the branch of Chemical Engineering

A *student* who has obtained a BSc, having passed the *courses* listed below, and has attained in this *qualification* such standard as the Senate may require for this purpose, may be admitted to the third year of study of the Bachelor of Science in Engineering in the branch of Chemical Engineering:

CHEM1012A	Chemistry I
CHEM2003A	Chemistry II
CHEM3028A	Chemistry III
[CHMT1002A	Introduction to Process and Materials I or
(FEBE1002A	Engineering Analysis and Design 1A and
FEBE1004A	Engineering Analysis and Design 1B)]
CHMT2011A	Computing for Process Engineering II
[(CHMT2014A	Energy Balances and Applications II and
CHMT2013A	Process Engineering Fundamentals II) or
(CHMT2021A	Process Engineering Fundamentals A or
CHMT2023A	Process Engineering Fundamentals A) and
(CHMT2022A	Process Engineering Fundamentals B)]
ELEN1003A	Critical Thinking I
ELEN2000A	Electrical Engineering
ECON1002A	Economic concepts IA
[(MATH1034A	Algebra I and
MATH1036A	Calculus I) or

(MATH1042A	Mathematics IA and
MATH1043A	Mathematics IB)]
MATH2011A	Mathematics II
[PHYS1000A	Physics I (Major) or
(PHYS1032A	Physics IA and
PHYS1033A	Physics IB)]

2.1.1.6 Admission of BSc graduates to Bachelor of Science in Engineering in the branch of Metallurgy and Materials Engineering

A *student* who has obtained a BSc, having passed the *courses* listed below, and has attained in this *qualification* such standard as the *Senate* may require for this purpose, may be admitted to the third year of study of the Bachelor of Science in Engineering in the branch of Metallurgy and Materials Engineering:

CHEM1012A	Chemistry I
CHEM2001A	Chemistry II A
CHEM2007A	Materials Science II
CHEM3037A	Materials Science III
[CHMT1002A	Introduction to Process and Materials or
(FEBE1002A	Engineering Analysis and Design 1A and
FEBE1004A	Engineering Analysis and Design 1B)]
CHMT2009A	Introduction to Mineralogy and Earth Science II
CHMT2011A	Computing for Process Engineering II
CHMT2018A	Practical Metallurgy II
CHMT2017A	Introduction to Extractive Metallurgy II
ELEN1003A	Critical Thinking I
ECON1002A	Economic Concepts IA
HIST1010A	A Social History of Technology I
[(MATH1034A	Algebra I and
MATH1036A	Calculus I) or
(MATH1042A	Mathematics IA and
MATH1043A	Mathematics IB)]
MATH2007A	Multivariable Calculus II
MATH2018A	Group Theory II
MATH2019A	Linear Algebra II
[PHYS1000A	Physics I (Major) or
(PHYS1032A	Physics IA and
PHYS1033A	Physics IB)]

2.1.1.7 Admission of BSc graduates to Bachelor of Science in Engineering in the branch of Mechanical Engineering or Industrial Engineering

A *student* who has obtained a BSc, having passed the *courses* listed below or their equivalents, and has attained in this *qualification* such standard as the *Senate* may require for this purpose, may be admitted to the third year of study of the Bachelor of Science in Engineering in the branch of Mechanical Engineering or Industrial Engineering:

[CHEM1033A	Chemistry I (Auxiliary) or
CHEM1051A	Engineering Chemistry]
[MATH1001A	Mathematics I or

(MATH1042A	Mathematics IA and
MATH1043A	Mathematics IB)]
[MATH2011A	Mathematics II
MATH2026A	Mathematics II]
[MECN1001A	Introduction to Mechanical Engineering and Design or
FEBE1002A	Engineering Analysis and Design 1B]
[MECN1003A	Engineering Drawing or
FEBE1004A	Engineering Analysis and Design 1A]
MECN2022A	Fluid Mechanics
MECN2011A	Applied Mechanics A
MECN2012A	Computing Skills and Software Development
MECN2005A**	Mechanical Engineering Laboratory I
MECN2024A	Engineering Thermodynamics
MECN2010A	Introduction to Materials Science and Engineering
MECN2014A	Mechanical Engineering Design I
MECN3033A**	Introduction to Nuclear Engineering
MECN3034A**	Introduction to Nuclear Safety
[PHYS1000A	Physics I (Major) or
(PHYS1032A	Physics IA and
PHYS1033A	Physics IB)]
[PHYS1015A	Mechanics or
PHYS1034A	Applied Physics I]
PHYS2001A	Physics II A (Major)
PHYS2002A	Physics II B (Major)
PHYS2011A	Introduction to Reactor Physics
PHYS2012A	Basic Nuclear Physics
PHYS3000A	Quantum Mechanics III
PHYS3001A	Applications of Quantum Mechanics III
PHYS3002A	Statistical Physics III
PHYS3003A	Waves and Modern Optics III
PHYS3006A	Advanced Experimental Physics and Project III

****MECN2005A Mechanical Engineering Laboratory I is a requirement for a *student* who has in or before 2016, completed MECN3023A Introduction to Nuclear Engineering and MECN3024A Introduction to Nuclear Safety.**

MECN2005A Mechanical Engineering Laboratory I, MECN3023A Introduction to Nuclear Engineering and MECN3024 Introduction to Nuclear Safety are replaced by MECN3033A Introduction to Nuclear Engineering and MECN3034A Introduction to Nuclear.

2.1.1.8 Articulation into third year Bachelor of Science in Engineering in the branch of Industrial Engineering

- a) A Bachelor of Science in Engineering *student* not registered in the branch of Industrial Engineering may proceed to the third year of this branch if s/he has passed all the first and second year *courses* in any other branch.

- b) A Bachelor of Science graduate who has completed the BSc in one of the fields of Chemistry with Chemical Engineering, Materials Science with Metallurgy or Nuclear Sciences and Engineering may proceed to the third year of Industrial Engineering.

2.1.1.8 (a) In exceptional cases, subject to timetable clashes, prerequisites and co-requisites, Senate may determine in her/his case whether a second year BSc (Eng) student may include in her/his curriculum one or more third year courses from Industrial Engineering.

2.1.2 Curricula

2.1.2.1 Length of Curriculum

1) BSc (Eng) (all branches)

The length of *curriculum* extends over not fewer than 4 years of full time study or 6 years of part time study.

2.1.2.2 Special curriculum for Engineering graduates

A *student* upon whom the award of Bachelor of Science in Engineering has been conferred in one branch or option may proceed in another branch or option upon such special *curriculum* as the *Senate* may determine to be appropriate in her/his case.

After s/he has satisfied the requirements of this *curriculum* s/he shall be entitled to the appropriate endorsement on her/his award certificate in terms of Rule G16.2.

2.1.2.3 Special curriculum in Mining Engineering for Engineering Science graduates

A *student* upon whom a Bachelor of Science, Bachelor of Engineering Science, or an equivalent *qualification* has been awarded and who has obtained a specific standard, as determined by the *Senate*, may be admitted to the third year of study in Mining Engineering.

2.1.2.4 Curriculum information for Bachelor of Science in Engineering (all branches)

a) Branch of Aeronautical Engineering

Programme Code: EFA06

NQF Exit Level: 8

Plan Code: EPAAER20

Total NQF Credits: 636

Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
CHEM1051A	Engineering Chemistry	12	5
FEBE1000A	Introduction to the Engineering Profession	12	5
FEBE1002A	Engineering Analysis and Design IA	12	5
FEBE1004A	Engineering Analysis and Design IB	12	5
MATH1042A	Engineering Mathematics IA	18	5
MATH1043A	Engineering Mathematics IB	18	5
PHYS1032A	Engineering Physics IA	18	5
PHYS1033A	Engineering Physics IB	18	5
PHYS1034A	Applied Physics I	12	5

A *student* shall also complete one of the following *courses* as may be offered in an academic year:

Course Code	Course Description	NQF Credits	NQF Level
AFRL1003A	Elementary IsiZulu Language and Culture IA	18	5
AFRL1005A	Elementary Sesotho Language and Culture IA	18	5
INTR1010A	The International Relations of South Africa and Africa	18	5
POLS1007A	Introduction to Political Studies	18	5
SOCL1013A	Southern Africa in the Era of Globalisation	18	5
SOCL1014A	Identity and Society	18	5
PHIL1002A	Introduction to Ethics I	18	5
PHIL1003A	Introduction to Philosophy: Knowledge and Reality	18	5
HIST1011A	Global Encounters and Contemporary Realities 1A	18	5
Year of Study II			
ELEN2000A	Electrical Engineering	18	6
MATH2011A	Mathematics II	27	6
MECN2005A	Mechanical Engineering Laboratory I	9	6
MECN2010A	Introduction to Materials Science and Engineering	12	6
MECN2011A	Applied Mechanics A	15	6
MECN2012A	Computing Skills and Software Development	15	6
MECN2013A	Applied Mechanics B	15	6
MECN2025A	Engineering Design	15	6
MECN2026A	Machine Elements	9	6
MECN2022A	Fluid Mechanics	12	6
MECN2024A	Engineering Thermodynamics	12	6
Year of Study III			
MATH3026A	Mathematical Methods	15	7
MECN3003A	Aeronautical Engineering Investigation	15	7
MECN3038A	Aeronautical Engineering Design	21	7
MECN3043A	Manufacturing Processes	9	7
MECN3008A	Introduction to Aeronautics	9	7
MECN3012A	Mechatronics I	15	7
MECN3013A	Business Management	12	7
MECN3027A	Mechanical Vibrations	15	7
MECN3028A	Engineering in its Social Context	18	7
MECN3032A	Numerical Methods and Statistics	18	7
MECN3035A	Aircraft Structures	12	7
MECN3036A	Incompressible Flows	12	7
A student shall also complete the following course to the satisfaction of the Senate:			
MECN1998A	Vacation Work I (Mechanical)	0	N/A

Course Code	Course Description	NQF Credits	NQF Level
Year of Study IV			
MECN4005A	Design Project	39	8
MECN4006A	Research Project	39	8
MECN4020A	Systems Management and Integration	12	8
MECN4024A	Gas Dynamics and Propulsion	15	8
MECN4025A	Aerodynamics	12	8
MECN4026A	Flight Dynamics	12	8
MECN4027A	Aircraft Structures II	12	8
MECN4029A	Mechatronics II	15	8
A student shall also complete the following courses to the satisfaction of the Senate:			
MECN1996A	Engineering Professional Activity	0	N/A
MECN1999A	Vacation Work II (Mechanical)	0	N/A
A student who in the final year of study has not completed the elective in the first year of study is also required to complete:			
MECN1004A	Selected Topics in Social Science	12	5

b) Branch of Chemical Engineering

Programme Code: EFA00

NQF Exit Level: 8

Plan Code: EPACHM20

Total NQF Credits: 598

Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
CHEM1051A	Engineering Chemistry	12	5
FEBE1000A	Introduction to the Engineering Profession	12	5
FEBE1002A	Engineering Analysis and Design IA	12	5
FEBE1004A	Engineering Analysis and Design IB	12	5
MATH1042A	Engineering Mathematics IA	18	5
MATH1043A	Engineering Mathematics IB	18	5
PHYS1032A	Engineering Physics IA	18	5
PHYS1033A	Engineering Physics IB	18	5
PHYS1034A	Applied Physics I	12	5
A student shall also complete one of the following courses as may be offered in an academic year:			
AFRL1003A	Elementary IsiZulu Language and Culture IA	18	5
AFRL1005A	Elementary Sesotho Language and Culture IA	18	5
INTR1010A	The International Relations of South Africa and Africa	18	5
POLS1007A	Introduction to Political Studies	18	5
SOCL1013A	Southern Africa in the Era of Globalisation	18	5

Course Code	Course Description	NQF Credits	NQF Level
SOCL1014A	Identity and Society	18	5
PHIL1002A	Introduction to Ethics I	18	5
PHIL1003A	Introduction to Philosophy: Knowledge and Reality	18	5
HIST1011A	Global Encounters and Contemporary Realities 1A	18	5
Year of Study II			
CHMT2011A	Computing for Process Engineering	15	6
CHEM2032A	Engineering Chemistry IIA	18	6
CHEM2033A	Engineering Chemistry IIB	18	6
CHMT2021A	Process Engineering Fundamentals A	20	6
CHMT2023A	Process Engineering Fundamentals B	20	6
ECON1002A	Economic Concepts 1A	18	5
ELEN2000A	Electrical Engineering	18	6
MATH2011A	Mathematics II	27	6
Year of Study III			
CHMT3004A	Chemical Engineering Laboratory	18	7
CHMT3008A	Numerical Methods	12	7
CHMT3024A	Environmental Process Engineering	9	7
CHMT3038A	Momentum and Heat Transport	18	7
CHMT3039A	Mass Transport and Operations	18	7
CHMT3040A	Applied Thermodynamics	12	7
CHMT3041A	Chemical Engineering Thermodynamics	12	7
CHMT3042A	Chemical Reaction Engineering A	12	7
CHMT3043A	Chemical Reaction Engineering B	12	7
CHMT3044A	Process Design Principles A	12	7
CHMT3045A	Process Design Principles B	12	7
Year of Study IV			
CHMT4005A	Management for Process Engineers	12	8
CHMT4006A	Solid Fluid Systems	9	8
CHMT4009A	Chemical Engineering Design	30	8
CHMT4011A	Process Control	12	8
CHMT4019A	Chemical Engineering Research Project	30	8
CHMT4029A	Biochemical Engineering	9	8
A student is required to select one of the following subject combinations:			
i) Extractive Metallurgy			
CHMT4000A	Hydrometallurgy	9	8
CHMT4030A	Fundamentals of Pyrometallurgy	9	8

Course Code	Course Description	NQF Credits	NQF Level
CHMT4031A	Fundamentals of Mineral Processing	9	8
ii) Advanced Chemical Engineering			
CHMT4032A	Advanced Chemical Reaction Engineering	9	8
CHMT4033A	Waste Water Engineering	9	8
CHMT4034A	Synthetic Fuels	9	8

c) Branch of Civil Engineering**Programme Code: EFA01****NQF Exit Level: 8****Plan Code: EPACIV20****Total NQF Credits: 608**

Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
CHEM1051A	Engineering Chemistry	12	5
FEBE1000A	Introduction to the Engineering Profession	12	5
FEBE1002A	Engineering Analysis and Design IA	12	5
FEBE1004A	Engineering Analysis and Design IB	12	5
MATH1042A	Engineering Mathematics IA	18	5
MATH1043A	Engineering Mathematics IB	18	5
PHYS1032A	Engineering Physics IA	18	5
PHYS1033A	Engineering Physics IB	18	5
PHYS1034A	Applied Physics I	12	5
<i>A student shall also complete one of the following courses as may be offered in an academic year:</i>			
AFRL1003A	Elementary IsiZulu Language and Culture IA	18	5
AFRL1005A	Elementary Sesotho Language and Culture IA	18	5
INTR1010A	The International Relations of South Africa and Africa	18	5
POLS1007A	Introduction to Political Studies	18	5
SOCL1013A	Southern Africa in the Era of Globalisation	18	5
SOCL1014A	Identity and Society	18	5
PHIL1002A	Introduction to Ethics I	18	5
PHIL1003A	Introduction to Philosophy: Knowledge and Reality	18	5
HIST1011A	Global Encounters and Contemporary Realities 1A	18	5
<i>A student shall also complete the following course to the satisfaction of the Senate:</i>			
CIVN1996A	Vacation Work (Civil)	0	N/A
Year of Study II			
CIVN2008A	Materials and Structures I	15	6
CIVN2009A	Materials and Structures II	15	6

Course Code	Course Description	NQF Credits	NQF Level
CIVN2010A	Numerical Methods	15	6
CIVN2011A	Probability Theory and Mathematical Statistics for Engineers	15	6
CIVN2013A	Introduction to Environmental Engineering	15	6
CIVN2014A	Engineering Computing	15	6
CIVN2016A	Engineering Economics and Infrastructure Planning	15	6
GEOL2027A	Geology for Civil Engineers	15	6
MATH2026A	Mathematics II	13	6
MINN2016A	Engineering Surveying	16	6
Year of Study III			
CIVN3001A	Construction Materials I	15	7
CIVN3004A	Geotechnical Engineering I	15	7
CIVN3010A	Structural Steel Design	15	7
CIVN3011A	Reinforced Concrete Design	15	7
CIVN3012A	Hydrology	15	7
CIVN3024A	Fluid Mechanics and Hydraulics	15	7
CIVN3025A	Structural Analysis I	15	7
CIVN3026A	Structural Analysis II	15	7
CIVN3017A	Systems Analysis and Optimisation	15	7
CIVN3027A	Transportation Engineering	15	7
A student shall also complete the following course to the satisfaction of the Senate:			
CIVN3032A	Practical Training (Civil)	0	N/A
Year of Study IV			
CIVN4000A	Construction Materials II	21	8
CIVN4004A	Geotechnical Engineering II	21	8
CIVN4005A	Investigational Project	27	8
CIVN4006A	Integrated Resource Management	21	8
CIVN4010A	Hydraulic Engineering	21	8
CIVN4014A	Structural Engineering	21	8
CIVN4015A	Civil Engineering Design	27	8

d) Branch of Electrical Engineering**Programme Code: EFA03****NQF Exit Level: 8****Plan Code: EPAELC20****Total NQF Credits: 598**

Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
CHEM1051A	Engineering Chemistry	12	5
FEBE1000A	Introduction to the Engineering Profession	12	5
FEBE1002A	Engineering Analysis and Design IA	12	5
FEBE1004A	Engineering Analysis and Design IB	12	5
MATH1042A	Engineering Mathematics IA	18	5
MATH1043A	Engineering Mathematics IB	18	5
PHYS1032A	Engineering Physics IA	18	5
PHYS1033A	Engineering Physics IB	18	5
PHYS1034A	Applied Physics I	12	5
A student shall also complete one of the following courses as may be offered in an academic year:			
AFRL1003A	Elementary IsiZulu Language and Culture IA	18	5
AFRL1005A	Elementary Sesotho Language and Culture IA	18	5
INTR1010A	The International Relations of South Africa and Africa	18	5
POLS1007A	Introduction to Political Studies	18	5
SOCL1013A	Southern Africa in the Era of Globalisation	18	5
SOCL1014A	Identity and Society	18	5
PHIL1002A	Introduction to Ethics I	18	5
PHIL1003A	Introduction to Philosophy: Knowledge and Reality	18	5
HIST1011A	Global Encounters and Contemporary Realities 1A	18	5
Year of Study II			
COMS2004A	Data Structures and Algorithms	18	6
ELEN2003A	Electric and Magnetic Systems	18	6
ELEN2020A	Software Development I	16	6
ELEN2005A	Signals and Systems I	12	6
ELEN2021A	Microprocessors	14	6
ELEN2016A	Electronics I	16	6
ELEN2017A	Electric Circuits	12	6
MATH2014A	Mathematics II	33	6
PHYS2007A	Physics II (Electrical)	15	6
A student shall also complete the following course to the satisfaction of the Senate:			
ELEN1998A	Vacation Work I (Electrical)	0	N/A

Course Code	Course Description	NQF Credits	NQF Level
A <i>student</i> shall at the beginning of the third year of the <i>curriculum</i> elect either to continue with the Electrical Engineering curriculum, or register for the Information Engineering curriculum			
Year of Study III			
ELEN3000A	Electromagnetic Engineering	12	7
ELEN3002A	Electronics II	15	7
ELEN3003A	Power Engineering	15	7
ELEN3007A	Probabilistic Systems Analysis	12	7
ELEN3009A	Software Development II	18	7
ELEN3012A	Signals and Systems IIA	12	7
ELEN3013A	Signals and Systems IIB	9	7
ELEN3016A	Control I	18	7
ELEN3017A	Electrical Engineering Design	15	7
ELEN3018A	Economics of Design	12	7
MATH3025A	Mathematical Methods	15	7
Year of Study IV			
The <i>curriculum</i> for the fourth year of study shall comprise eight <i>courses</i> consisting of five compulsory <i>courses</i> :			
ELEN4000A	Electrical Engineering Design II	24	8
ELEN4002A	Electrical Engineering Laboratory	33	8
ELEN4006A	Measurement Systems	15	8
ELEN4019A	Selected Topics in Sociology	12	8
MECN4020A	Systems Management and Integration	12	8
and three elective <i>courses</i> selected from the following as may be offered in an <i>academic year</i> :			
ELEN4001A	High Frequency Techniques	15	8
ELEN4003A	High Voltage Engineering	15	8
ELEN4009A	Software Engineering	15	8
ELEN4010A	Software Development III	15	8
ELEN4014A	Electromechanical Conversion	15	8
ELEN4016A	Control II	15	8
ELEN4018A	Power Systems	15	8
ELEN4020A	Data Intensive Computing in Data Science	15	8
ELEN4023A	Renewable Energy	15	8

Electrical Engineering (Information Engineering)**Programme Code: EFA04****NQF Exit Level: 8****Plan Code: EPAINF20****Total NQF Credits: 601**

Course Code	Course Description	NQF Credits	NQF Level
Year of Study III			
APPM3021A	Computational Mathematics	15	7
ELEN3002A	Electronics II	15	7
ELEN3007A	Probabilistic Systems Analysis	12	7
ELEN3009A	Software Development II	18	7
ELEN3012A	Signals and Systems IIA	12	7
ELEN3013A	Signals and Systems IIB	9	7
ELEN3015A	Data and Information Management	18	7
ELEN3016A	Control I	18	7
ELEN3017A	Electrical Engineering Design	15	7
ELEN3018A	Economics of Design	12	7
ELEN3024A	Communication Fundamentals	12	7
Year of Study IV			
The <i>curriculum</i> for the fourth year of study shall comprise eight <i>courses</i> consisting of five compulsory <i>courses</i> :			
ELEN4006A	Measurement Systems	15	8
ELEN4011A	Information Engineering Design	24	8
ELEN4012A	Information Engineering Laboratory	33	8
ELEN4019A	Selected Topics in Sociology	12	8
MECN4020A	Systems Management and Integration	12	8
and three elective <i>courses</i> selected from the following as may be offered in an <i>academic year</i> :			
ELEN4009A	Software Engineering	15	8
ELEN4010A	Software Development III	15	8
ELEN4016A	Control II	15	8
ELEN4017A	Network Fundamentals	15	8
ELEN4020A	Data Intensive Computing in Data Science	15	8
ELEN4022A	Full Stack Quantum Computing	15	8

e) Branch of Industrial Engineering			
Programme Code: EFA07		NQF Exit Level: 8	
Plan Code: EPAIND20		Total NQF Credits: 620	
Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
CHEM1051A	Engineering Chemistry	12	5
FEBE1000A	Introduction to the Engineering Profession	12	5
FEBE1002A	Engineering Analysis and Design IA	12	5
FEBE1004A	Engineering Analysis and Design IB	12	5
MATH1042A	Engineering Mathematics IA	18	5
MATH1043A	Engineering Mathematics IB	18	5
PHYS1032A	Engineering Physics IA	18	5
PHYS1033A	Engineering Physics IB	18	5
PHYS1034A	Applied Physics I	12	5
<i>A student shall also complete one of the following courses as may be offered in an academic year:</i>			
AFRL1003A	Elementary IsiZulu Language and Culture IA	18	5
AFRL1005A	Elementary Sesotho Language and Culture IA	18	5
INTR1010A	The International Relations of South Africa and Africa	18	5
POLS1007A	Introduction to Political Studies	18	5
SOCL1013A	Southern Africa in the Era of Globalisation	18	5
SOCL1014A	Identity and Society	18	5
PHIL1002A	Introduction to Ethics I	18	5
PHIL1003A	Introduction to Philosophy: Knowledge and Reality	18	5
HIST1011A	Global Encounters and Contemporary Realities 1A	18	5
Year of Study II			
ELEN2000A	Electrical Engineering	18	6
MATH2011A	Mathematics II	27	6
MECN2005A	Mechanical Engineering Laboratory I	9	6
MECN2010A	Introduction to Materials Science and Engineering	12	6
MECN2011A	Applied Mechanics A	15	6
MECN2012A	Computing Skills and Software Development	15	6
MECN2013A	Applied Mechanics B	15	6
MECN2025A	Engineering Design	15	6
MECN2026A	Machine Elements	9	6
MECN2022A	Fluid Mechanics	12	6
MECN2024A	Engineering Thermodynamics	12	6

Course Code	Course Description	NQF Credits	NQF Level
Year of Study III			
MECN3004A	Industrial Engineering Design	27	7
MECN3006A	Industrial Engineering Investigation	15	7
MECN3012A	Mechatronics I	15	7
MECN3013A	Business Management	12	7
MECN3014A	Operations Management: Techniques	15	7
MECN3025A	Manufacturing Technology: Processes	12	7
MECN3026A	Principles of Organisational Behaviour	9	7
MECN3028A	Engineering in its Social Context	18	7
MECN3030A	Operations Research	15	7
MECN3031A	Mathematical Topics (Industrial) (Not to be taken by students articulating from EFA01)	18	7
MATH3036A	Mathematical Methods (Industrial)	7	7
Students articulating from EFA01 will be required to obtain 15 credits from the third year EFA01 curriculum subject to pre and corequisite requirements.			
A student shall also complete the following course to the satisfaction of the Senate:			
MECN1998A	Vacation Work I (Mechanical)	0	N/A
Year of Study IV			
MECN4005A	Design Project	39	8
MECN4006A	Research Project	39	8
MECN4009A	Manufacturing Technology: Systems	15	8
MECN4015A	Business Studies	12	8
MECN4020A	Systems Management and Integration	12	8
MECN4028A	Decision Support and Intelligence Systems	15	8
MECN4030A	Operations Management: Systems Integration	16	8
A student shall also complete the following courses to the satisfaction of the Senate:			
MECN1996A	Engineering Professional Activity	0	N/A
MECN1999A	Vacation Work II (Mechanical)	0	N/A
A student who in the final year of study has not completed the elective in the first year of study is also required to complete:			
MECN1004A	Selected Topics in Social Science	12	5

f) Branch of Mechanical Engineering**Programme Code: EFA05****NQF Exit Level: 8****Plan Code: EPAMCN20****Total NQF Credits: 636**

Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
CHEM1051A	Engineering Chemistry	12	5
FEBE1000A	Introduction to the Engineering Profession	12	5
FEBE1002A	Engineering Analysis and Design IA	12	5
FEBE1004A	Engineering Analysis and Design IB	12	5
MATH1042A	Engineering Mathematics IA	18	5
MATH1043A	Engineering Mathematics IB	18	5
PHYS1032A	Engineering Physics IA	18	5
PHYS1033A	Engineering Physics IB	18	5
PHYS1034A	Applied Physics I	12	5
<i>A student shall also complete one of the following courses as may be offered in an academic year:</i>			
AFRL1003A	Elementary IsiZulu Language and Culture IA	18	5
AFRL1005A	Elementary Sesotho Language and Culture IA	18	5
INTR1010A	The International Relations of South Africa and Africa	18	5
POLS1007A	Introduction to Political Studies	18	5
SOCL1013A	Southern Africa in the Era of Globalisation	18	5
SOCL1014A	Identity and Society	18	5
PHIL1002A	Introduction to Ethics I	18	5
PHIL1003A	Introduction to Philosophy: Knowledge and Reality	18	5
HIST1011A	Global Encounters and Contemporary Realities 1A	18	5
Year of Study II			
ELEN2000A	Electrical Engineering	18	6
MATH2011A	Mathematics II	27	6
MECN2005A	Mechanical Engineering Laboratory I	9	6
MECN2010A	Introduction to Materials Science and Engineering	12	6
MECN2011A	Applied Mechanics A	15	6
MECN2012A	Computing Skills and Software Development	15	6
MECN2013A	Applied Mechanics B	15	6
MECN2025A	Engineering Design	15	6
MECN2026A	Machine Elements	9	6
MECN2022A	Fluid Mechanics	12	6
MECN2024A	Engineering Thermodynamics	12	6

Course Code	Course Description	NQF Credits	NQF Level
Year of Study III			
MATH3026A	Mathematical Methods	15	7
MECN3007	Mechanical Engineering Investigation	15	7
MECN3010A	Mechanics of Solids I	15	7
MECN3012A	Mechatronics I	15	7
MECN3013A	Business Management	12	7
MECN3043A	Manufacturing Processes	9	7
MECN3039A	Mechanical Engineering Design	21	7
MECN3027A	Mechanical Vibrations	15	7
MECN3028A	Engineering in its Social Context	18	7
MECN3032A	Numerical Methods and Statistics	18	7
MECN3036A	Incompressible Flows	12	7
MECN3037A	Fundamentals of Heat Transfer	12	7
A student shall also complete the following course to the satisfaction of the Senate:			
MECN1998A	Vacation Work I (Mechanical)	0	N/A
Year of Study IV			
MECN4005A	Design Project	39	8
MECN4006A	Research Project	39	8
MECN4020A	Systems Management and Integration	12	8
MECN4023A	Mechanics of Solids II	15	8
MECN4029A	Mechatronics II	15	8
MECN4031A	Compressible Flows	15	8
MECN4032A	Energy Conversion and Utilisation Systems	15	8
A student shall also complete the following courses to the satisfaction of the Senate:			
MECN1996A	Engineering Professional Activity	0	N/A
MECN1999A	Vacation Work II (Mechanical)	0	N/A
A student who in the final year of study has not completed the elective in the first year of study is also required to complete:			
MECN1004A	Selected Topics in Social Science	12	5

g) Branch of Metallurgy and Materials Engineering**Programme Code: EFA08****NQF Exit Level: 8****Plan Code: EPAMET20****Total NQF Credits: 597**

Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
CHEM1051A	Engineering Chemistry	12	5

Course Code	Course Description	NQF Credits	NQF Level
FEBE1000A	Introduction to the Engineering Profession	12	5
FEBE1002A	Engineering Analysis and Design IA	12	5
FEBE1004A	Engineering Analysis and Design IB	12	5
MATH1042A	Engineering Mathematics IA	18	5
MATH1043A	Engineering Mathematics IB	18	5
PHYS1032A	Engineering Physics IA	18	5
PHYS1033A	Engineering Physics IB	18	5
PHYS1034A	Applied Physics I	12	5
A student shall also complete one of the following courses as may be offered in an academic year:			
AFRL1003A	Elementary IsiZulu Language and Culture IA	18	5
AFRL1005A	Elementary Sesotho Language and Culture IA	18	5
INTR1010A	The International Relations of South Africa and Africa	18	5
POLS1007A	Introduction to Political Studies	18	5
SOCL1013A	Southern Africa in the Era of Globalisation	18	5
SOCL1014A	Identity and Society	18	5
PHIL1002A	Introduction to Ethics I	18	5
PHIL1003A	Introduction to Philosophy: Knowledge and Reality	18	5
HIST1011A	Global Encounters and Contemporary Realities 1A	18	5
Year of Study II			
CHEM2032A	Engineering Chemistry IIA	18	6
CHMT2009A	Introductory Mineralogy and Earth Sciences	9	6
CHMT2011A	Computing for Process Engineering	15	6
CHMT2017A	Introduction to Extractive Metallurgy	15	6
CHMT2018A	Practical Metallurgy	12	6
CHMT2019A	Materials Science and Engineering	15	6
CHMT2025A	Process Engineering Fundamentals A	20	6
ECON1002A	Economic Concepts IA	18	5
ELEN2000A	Electrical Engineering	18	6
MATH2012A	Mathematics II	15	6
Year of Study III			
APPM3037A	Numerical Methods (Metallurgy)	9	7
CHMT3014A	Engineering Failure Analysis	9	7
CHMT3019A	Kinetics and Transport Processes in Metallurgical Engineering	15	7
CHMT3021A	Solidification, Heat Treatment and Microstructure	15	7
CHMT3024A	Environmental Process Engineering	9	7

Course Code	Course Description	NQF Credits	NQF Level
CHMT3025A	Crystal Structure and Analysis	12	7
CHMT3027A	Corrosion and Wear	15	7
CHMT3028A	Non-Ferrous Pyrometallurgy	12	7
CHMT3046A	Metallurgical Thermodynamics I	12	7
CHMT3047A	Metallurgical Thermodynamics II	12	7
CHMT3048A	Process and Materials Design I	11	7
CHMT3049A	Process and Materials Design II	11	7
STAT3029A	Engineering Statistics	9	7
Year of Study IV			
CHMT4002A	Physical Chemistry of Iron and Steel Manufacturing	12	8
CHMT4003A	Metallurgical Design	30	8
CHMT4004A	Research Project	30	8
CHMT4005A	Management for Process Engineers	12	8
CHMT4008A	Particulate Systems	12	8
CHMT4011A	Process Control	12	8
CHMT4015A	Welding and Forming Processes	9	8
CHMT4017A	Structure and Properties of Engineering Materials	12	8
CHMT4020A	Hydrometallurgical Processes	12	8

h) Branch of Mining Engineering

Programme Code: EFA09

NQF Exit Level: 8

Plan Code: EPAMIN20

Total NQF Credits: 592

Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
CHEM1051A	Engineering Chemistry	12	5
FEBE1000A	Introduction to the Engineering Profession	12	5
FEBE1002A	Engineering Analysis and Design IA	12	5
FEBE1004A	Engineering Analysis and Design IB	12	5
MATH1042A	Engineering Mathematics IA	18	5
MATH1043A	Engineering Mathematics IB	18	5
PHYS1032A	Engineering Physics IA	18	5
PHYS1033A	Engineering Physics IB	18	5
PHYS1034A	Applied Physics I	12	5
A student shall also complete one of the following courses as may be offered in an academic year:			
AFRL1003A	Elementary IsiZulu Language and Culture IA	18	5

Course Code	Course Description	NQF Credits	NQF Level
AFRL1005A	Elementary Sesotho Language and Culture IA	18	5
INTR1012A	International Relations: An Introduction to the Discipline	18	5
POLS1007A	Introduction to Political Studies	18	5
SOCL1013A	Southern Africa in the Era of Globalisation	18	5
SOCL1014A	Identity and Society	18	5
PHIL1002A	Introduction to Ethics I	18	5
PHIL1003A	Introduction to Philosophy: Knowledge and Reality	18	5
HIST1011A	Global Encounters and Contemporary Realities 1A	18	5
Year of Study II			
APPM2017A	Applied Mathematics IIA	13	6
GEOL1006A	Geology IA	16	5
GEOL1007A	Geology IB	16	5
MATH2026A	Mathematics II	13	6
MINN2006A	Engineering Services for Mining	16	6
MINN2008A	Introduction to Underground and Surface Mining Methods	16	6
MINN2010A	Computer Applications in Mining	8	6
MINN2012A	Explosives Engineering	10	6
MINN2014A	Mechanical Excavation of Rock	16	6
MINN2016A	Engineering Surveying	16	6
MINN2018A	Digital Technologies and Mine Data Analytics	5	6
MINN2020A	Computer Programming for Mining	8	6
MINN2022A	Professional Development	5	6
<i>A student shall also complete the following courses to the satisfaction of the Senate:</i>			
MINN2024A	Computer Programming Bootcamp (Mining)	0	N/A
MINN1996A	Practical Workshop Training (Mining)	0	N/A
Year of Study III			
CHMT3050A	Ore Dressing and Extractive Metallurgy	10	7
GEOL3051A	Ore Body Modelling	16	7
MINN3015A	Mine Transportation, Automation and Robotics	13	7
MINN3016A	Mineral Resources Evaluation	16	7
MINN3017A	Computerised Mine Design	10	7
MINN3018A	Rock Mechanics	16	7
MINN3019A	Mine Ventilation and Climate Control	16	7
MINN3020A	Water, Energy and the Environment	5	7
MINN3021A	Mine Surveying and Geospatial Techniques	16	7

Course Code	Course Description	NQF Credits	NQF Level
MINN3022A	Underground Mining Systems	18	7
MINN3023A	Surface Mining Systems	18	7
Year of Study IV			
MINN4011A	Mine Management Principles and Entrepreneurship	13	8
MINN4013A	Financial Valuation	16	8
MINN4014A	Mine Design	36	8
MINN4015A	Project Report	16	8
MINN4016A	Rock Engineering	18	8
MINN4012A	Mining Optimisation Techniques and Systems Engineering	13	8
MINN4017A	Health, Safety and Mining Law	18	8
A student shall also complete the following courses to the satisfaction of the Senate:			
MINN1995A	Mine Technical Visits	0	N/A
MINN1998A	Vacation Work I (Mining)	0	N/A

2.1.3 Progression Rules

2.1.3.1 Bachelor of Science in Engineering (all branches)

- A student shall not be admitted to the second year of study unless s/he has obtained *credit* in all the courses prescribed for the first year of study and has satisfied all the other requirements prescribed by or determined in terms of these rules:
Provided that a student who has not obtained *credit* for all the qualifying courses prescribed for the first year, or who has not satisfied all the other requirements prescribed by or determined in terms of these rules may be permitted by the Senate to include in her/his curriculum in addition to the courses being repeated one or more of the courses prescribed for the second year, provided that the total number of credits prescribed for the year of study is not exceeded and is not restricted in terms of Rule G5.1, G6.2, G7.3 and 2.3.
- Except where otherwise permitted in terms of these rules, a student shall not be admitted to the third year of study unless s/he has obtained *credit* in all the qualifying courses prescribed for the first two years of study and has satisfied all the other requirements prescribed by or determined in terms of these rules:
Provided that a student who has not obtained *credit* for all the courses prescribed for the first two years, or who has not satisfied all the other requirements prescribed by or determined in terms of these rules may be permitted by the Senate to include in her/his curriculum in addition to the remaining second year courses one or more of the courses offered for the third year, provided that the total number of credits prescribed for the year of study is not exceeded and is not restricted in terms of Rule G5.1, G6.2, G7.3 and 2.3.
- A student shall not be admitted to the fourth year of study for the BSc (Eng) unless s/he has obtained *credit* in all the courses prescribed for the first three years of study and has satisfied all the other requirements prescribed by or determined in terms of these rules:
Provided that a student who has not obtained *credit* for all the courses prescribed for the third year, or who has not satisfied all the other requirements prescribed by or determined in terms of these rules may be permitted by the Senate to include in her/his curriculum in addition to the remaining third year courses one or more of the courses prescribed or offered for the fourth year, provided that the total number of credits prescribed for the year of study is not exceeded and is not restricted in terms of Rule G5.1, G6.2, G7.3 and 2.3.

- d) For the BSc (Eng) in the branch of Electrical Engineering, a *student* shall not be admitted to the fourth year of study unless s/he has obtained *credit* in all the *courses* prescribed for the first three years of study and has satisfied all the other requirements prescribed by or determined in terms of these rules:

Provided that a *student* who has not obtained *credit* for all the *courses* prescribed for the first three years, or who has not satisfied all the other requirements prescribed by or determined in terms of these rules may in an exceptional case be permitted to include in her/his *curriculum* one or more of the *courses* offered for the fourth year of study, provided that the total number of credits prescribed for the year of study is not exceeded and is not restricted in terms of Rule G5.1, G6.2, G7.3 and 2.3.

e) BSc (Eng) – Students admitted to second year in terms of 2.1.1.4

A *student* must –

- i) in her/his first year of registration for the second year *curriculum*, obtain *credit* in *courses* for which the total of the credits is a minimum of 60 percent of the total credits for the second year *curriculum* of the relevant branch of the BSc (Eng); or
- ii) if registered for the second year other than for the first time, or for third or fourth year obtain an aggregate as defined in 2.1.3.3 (1.1) of a minimum of 45 percent;
- iii) pass every *course* that s/he is repeating; and

A *student* who does not pass the Engineering Mathematics IA and Engineering Physics IA *courses* must achieve a mark between 40 and 49 percent in both *courses* in order to register for the Engineering Mathematics I B and Engineering Physics IB *courses* in the second semester.

2.1.3.2 Granting of Credit

1) Bachelor of Science in Engineering (all branches)

1.1) Aggregate

For the purposes of these rules an ‘aggregate’ is a weighted average of the final marks obtained in the group of *courses* contained in the *curriculum* for which a *student* is registered in any year of study in accordance with the *credits* prescribed by the rules and shown in parenthesis after each *course* in the *curricula*.

1.2) Unless otherwise provided for in the rules for a particular branch, the granting of credit for a course is determined as follows:

- a) A *student* who obtains the minimum aggregate as determined from time to time by the Senate and who in each *course* obtains the minimum mark, as determined from time to time by the Senate, may be granted *credit* in all the *courses* in her/his *curriculum*.
- b) A *student* who obtains the minimum aggregate but who fails to obtain the minimum mark in one or more *courses* may nevertheless be granted *credit* in all the *courses* in her/his *curriculum*. In deciding whether or not to grant *credit* in terms of this rule, the Senate may:

- i) require such a *student* to present himself/herself for an oral or other additional *assessment* in one or more or all of the *courses* in which s/he has failed to obtain the minimum mark,

or

- ii) permit such a *student* to present herself/ himself without further attendance for a supplementary *examination* in one or more or all of the *courses* which s/he has failed to pass except in the following *courses*:

CHMT2018A	Practical Metallurgy
CHMT3004A	Chemical Engineering Laboratory
CHMT3044A	Process Design Principles A
CHMT3045A	Process Design Principles B
CHMT3048A	Process and Materials Design I
CHMT3049A	Process and Materials Design II
CHMT4003A	Metallurgical Design
CHMT4004A	Research Project
CHMT4009A	Chemical Engineering Design
CHMT4019A	Chemical Engineering Research Project
COMS2004A	Data Structures and Algorithms
ELEN3017A	Electrical Engineering Design
ELEN3018A	Economics of Design
ELEN4000A	Electrical Engineering Design II
ELEN4002A	Electrical Engineering Laboratory
ELEN4011A	Information Engineering Design
ELEN4012A	Information Engineering Laboratory
MECN3030A	Operations Research
MECN4028A	Design Support and Intelligence Systems
GEOL1006A	Geology IA
GEOL1007A	Geology IB
GEOL3050A	Ore Body Modelling
MECN2005A	Mechanical Engineering Laboratory I
MECN3040A	Aeronautical Engineering Investigation
MECN3004A	Industrial Engineering Design
MECN3038A	Aeronautical Engineering Design
MECN3042A	Industrial Engineering Investigation
MECN3041A	Mechanical Engineering Investigation
MECN3012A	Mechatronics I
MECN3039A	Mechanical Engineering Design
MECN4005A	Design Project
MECN4006A	Research Project
MECN4015A	Business Studies
MINN2018A	Digital Technologies and Mine Data Analytics
MINN2020A	Computer Programming for Mining
MINN3017A	Computerised Mine Design

MINN2022A	Professional Development
MINN3020A	Water, Energy and the Environment
MINN4014A	Mine Design
MINN4015A	Project Report

and courses taken from the Faculty of Humanities as electives in the first year of study

or

- iii) require such a *student* to attend an additional period of instruction in one or more of the *courses* which s/he has failed to pass and to be assessed during and at the end of this additional period in which event the provisions of Rule G13.3 regarding satisfactory participation shall apply.

2.1.4 Exclusion Rules

A *student* who does not meet the minimum requirements of study may be refused permission by the *Senate* to renew her/his registration. If however, a *student* is permitted to renew her/his registration after having failed to satisfy the minimum requirements of study, s/he may be required to satisfy these and further conditions as the *Senate* may determine in her/his case.

1) Bachelor of Science in Engineering

A *student* must –

- a) pass every *course* that s/he is repeating;
- b) if registered for the first time in the first year, obtain *credit* in *courses* for which the total of the credits is a minimum of 60 percent of the total credits for the first-year *curriculum* of the relevant branch of the BSc (Eng); or
- c) if registered for the first year other than for the first time, or for second, third or fourth year, obtain an aggregate as defined in 2.1.3.3 (1.1) of a minimum of 45 percent.

2.2 General Degrees

Programme Name	Programme Code	NQF Exit Level
Bachelor of Architectural Studies: BAS	FBA00	7
Bachelor of Engineering Science in Biomedical Engineering: BEngSc (BME)	EBA00	7
Bachelor of Engineering Science: BEngSc (Digital Arts)	EBA01	7
Bachelor of Science in Construction Studies: BSc (Construction Studies)	FBA04	7
Bachelor of Science in Construction Studies: BSc (Construction Studies) in the field of Property Studies	FBA06	7
Bachelor of Science in Urban and Regional Planning: BSc (Urban and Regional Planning)	FBA05	7

2.2.1 Admission Rules

2.2.1.1 Minimum requirements for admission - National Senior Certificate (NSC)

1) BAS

A pass in English Home Language or first additional language at the *NSC* Scale of Achievement level 4 and a pass in Mathematics at the *NSC* Scale of Achievement level 4.

2) BEngSc

- a) A pass in English Home Language or first additional language at the *NSC* Scale of Achievement level 5; a pass in Physical Science at the *NSC* Scale of Achievement level 5; and a pass in Mathematics at the *NSC* Scale of Achievement level 5.
- b) A *student* who has successfully completed *courses* in Chemistry and Physics at a university or other institution recognised by the *Senate* for this purpose may be deemed by the *Senate* to have obtained a pass in Physical Science.

3) BSc (Construction Studies) and BSc (Urban and Regional Planning)

A pass in English Home Language or first additional language at the *NSC* Scale of Achievement level 5 and a pass in Mathematics at the *NSC* Scale of Achievement level 5.

NC(V) - Besides meeting the *University's* requirements an *applicant* who holds an *NC(V)* will be interviewed by the Dean, Assistant Dean and relevant Head of School.

2.2.1.2 Minimum requirements for admission to – non NSC matriculants

1) BAS, BSc (Construction Studies) and BSc (Urban and Regional Planning)

A pass in Mathematics and English (first or second language) at the Higher Grade or alternatively at a minimum of 60 percent at the Standard Grade.

2) BEngSc

- a) A pass in Physical Science at the Higher Grade or a standard of a minimum of 60 per cent at the Standard Grade.
- b) A pass in both Mathematics and Physical Science at the Higher Grade. In exceptional circumstances, the *Senate* may accept a standard of a minimum of 60 per cent in either or both of these subjects at the Standard Grade. A *student* who has successfully completed *courses* in Chemistry and Physics at a university or other institution recognised by the *Senate* for this purpose may be deemed by the *Senate* to have obtained a pass in Physical Science at the Higher Grade.

2.2.1.3 Compliance with minimum requirements does not guarantee admission

2.2.2 Curricula

2.2.2.1 Length of Curriculum

1) BAS, BEngSci (BME), BEngSci, BSc (Construction Studies), BSc (Construction Studies) in the field of Property Studies and BSc (Urban and Regional Planning)

The length of *curriculum* extends over not fewer than 3 years of full time study.

2.2.2.2 Curriculum Information for Bachelor of Architectural Studies

Programme Code: FBA00		NQF Exit Level: 7	
Plan Code: FPABAS10		Total NQF Credits: 432	
Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
APPM1000A	Applied Mathematics	7	5
ARPL1000A	Architectural Design and Theory I	60	5

Course Code	Course Description	NQF Credits	NQF Level
ARPL1001A	Theory and Practice of Construction I	30	5
ARPL1031A	Histories and Theories of Architecture I	8	5
ARPL1032A	History of Settlement and Architecture	12	5
ARPL1028A	Design Representation I	10	5
ARPL1029A	Digital Applications in Architecture II	10	5
ARPL1030A	Building Ecology	7	5
Year of Study II			
ARPL2000A	Architectural Design and Theory II	60	6
ARPL2002A	Theory and Practice of Construction II	30	6
ARPL2012A	Histories and Theories of Architecture II	20	6
ARPL2019A	Design Representation II	10	6
ARPL2020A	Digital Applications in Architecture II	10	6
CIVN2018A	Civil Engineering Theory I	7	6
ARPL2021A	Introduction to Structures	7	6
Year of Study III			
ARPL3002A	Small Office Practice	7	7
ARPL3005A	Architectural Design and Theory III	70	7
ARPL3021A	Histories and Theories of Architecture III	20	7
ARPL3031A	Theory and Practice of Construction III	33	7
CIVN3029A	Civil Engineering Theory II	7	7
CIVN3030A	Civil Engineering Theory III	7	7

2.2.2.3 Curriculum Information for Bachelor of Engineering Science in Biomedical Engineering

Programme Code: EBA00		NQF Exit Level: 7	
Plan Code: EPABME10		Total NQF Credits: 439	
Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
APES1002A	Introductory Physiology & Environmental Sciences I	18	5
CHEM1012A	Chemistry I	36	5
MATH1042A	Engineering Mathematics IA	18	5
MATH1043A	Engineering Mathematics IB	18	5
MCBG1000A	Introductory Molecular and Cell Biology I	18	5
PHYS1032A	Engineering Physics IA	18	5
PHYS1033A	Engineering Physics IB	18	5

Course Code	Course Description	NQF Credits	NQF Level
PHYS1034A	Applied Physics I	12	5
Year of Study II			
ELEN2003A	Electric and Magnetic Systems	18	6
ELEN2020A	Software Development I	16	6
ELEN2005A	Signals and Systems I	12	6
ELEN2006A	Microprocessors	15	6
ELEN2016A	Electronics I	16	6
ELEN2017A	Electric Circuits	12	6
HAEM2001A	Molecular and Cell Biology	9	6
MATH2014A	Mathematics II	33	6
PHYS2007A	Physics II (Electrical)	15	6
Year of Study III			
ANAT2020A	Anatomy	48	6
CHMT3017A	Biomedical Transport Phenomena	6	7
ELEN3028A	Biomedical Measurement, Instrumentation and Imaging	14	7
ELEN3012A	Signals and Systems IIA	12	7
ELEN3014A	Biomedical Signals, Systems and Control	9	7
PHSL2004A	Physiology and Medical Biochemistry I	48	6

2.2.2.4 Curriculum Information for Bachelor of Engineering Science in the field of Digital Art

Programme Code: EBA01	NQF Exit Level: 7
Plan Code: EPADA10	Total NQF Credits: 428

Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
FEBE1002A	Engineering Analysis and Design 1A	12	5
FEBE1004A	Engineering Analysis and Design 1B	12	5
MATH1042A	Engineering Mathematics IA	18	5
MATH1043A	Engineering Mathematics IB	18	5
PHYS1032A	Engineering Physics IA	18	5
PHYS1033A	Engineering Physics IB	18	5
PHYS1034A	Applied Physics I	12	5
WSOA1011A	Key Concepts in Game Design I	18	5
WSOA1012A	Key Concepts in Game Design II	18	5
Year of Study II			
COMS2004A	Data Structure and Algorithms	18	6

Course Code	Course Description	NQF Credits	NQF Level
ELEN2020A	Software Development I	16	6
ELEN2006A	Microprocessors	15	6
ELEN2016A	Electronics I	16	6
ELEN2017A	Electric Circuits	12	6
MATH2014A	Mathematics II	33	6
WSOA2006A	Digital Art Design Project	24	6
WSOA2009A	Introduction to Game Creation II A	24	6
WSOA2010A	Introduction to Game Creation II B	24	6
Year of Study III			
ELEN2003A	Electric and Magnetic Systems	18	6
ELEN2005A	Signals and Systems I	12	6
ELEN3020A	Professional Practice and Software Development	18	7
WSOA3000A	Introduction to the World Wide Web as Creative Medium III	18	7
WSOA3003A	Game Design IIIA	18	7
WSOA3004A	Game Design IIIB	18	7

2.2.2.5 Curriculum Information for Bachelor of Science in Urban and Regional Planning

Programme Code: FBA05	NQF Exit Level: 7
Plan Code: FPAURP11	Total NQF Credits: 402

Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
APPM1023A	Mathematical Techniques for Planners	18	5
ARPL1032A	History of Settlement and Architecture	12	5
ARPL1015A	Introduction to Environmental Interpretation	24	5
ARPL1016A	Introduction to Settlement Form and Design	24	5
GEOG1003A	Geography for Planners	24	5
ARPL1026A	Identity and Society I	18	5
Year of Study II			
ARPL1025A	Two and Three Dimensional Computer Aided Design and GIS	12	6
ARPL2006A	Planning for Housing Services, Infrastructure and Transport	12	6
ARPL2013A	Introduction to Land Management	18	6
ARPL2015A	Contemporary Design and Environmental Issues in South Africa	18	6
ARPL2017A	Histories, Theories and Futures of Planning	12	6

Course Code	Course Description	NQF Credits	NQF Level
ARPL2018A	Introduction to Environmental Planning	12	6
CIVN1005A	Introduction to Civil Engineering Infrastructure	12	5
ECON1002A	Economic Concepts IA	18	5
ECON1003A	Economic Concepts IB	18	5
APPM2019A	Quantitative Methods for Planners	12	6
Year of Study III			
The following <i>courses</i> are prescribed for all <i>students</i> in the third year of study:			
ARPL3010A	Comparative Planning Systems	12	7
ARPL3034A	Integrated Development Planning	24	7
ARPL3027A	Regional Planning and Local Economic Development	12	7
ARPL3028A	Development Policy and Processes in South Africa	12	7
ARPL3030A	Applications in Graphic and Spatial Communication in Planning	12	7
BUQS3028A	Property Development for Planners	18	7
ARPL3033A	Local Planning and Urban Design	18	7
ARPL3032A	The Politics of Planning and Housing	30	7

2.2.2.6 Curriculum Information for Bachelor of Science in Construction Studies

Programme Code: FBA04		NQF Exit Level: 7	
Plan Code: FPACSS10		Total NQF Credits: 409	
Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
APPM1022A	Introductory Statistics for Construction	18	5
BUQS1004A	Construction Drawings	12	5
BUQS1005A	Construction Materials and Environment	12	5
BUQS1006A	Construction Technology I	12	5
BUQS1007A	Communication Skills	12	5
BUQS1008A	Quantities and Specifications I	12	5
LAWS1000A	Commercial Law I	18	5
MATH1038A	Mathematics	18	5
PHYS1025A	Physics	30	5
Year of Study II			
BUQS2003A	Building Science I	12	6
BUQS2004A	Construction Technology II	12	6
BUQS2005A	Quantities and Specifications II	12	6
BUQS2006A	Site Management	12	6

Course Code	Course Description	NQF Credits	NQF Level
BUQS2008A	Accounting Principles in Construction	18	6
CIVN2018A	Civil Engineering Theory I	7	6
ECON1012A	Economics IA - Microeconomics	18	5
ECON1014A or ECON1015A	Economics IB - Macroeconomics	18	5
MINN2016A	Engineering Surveying	16	6
A student shall also complete the following course to the satisfaction of the Senate:			
BUQS1993A	Practical Experience II	0	N/A
Year of Study III			
BUQS3011A	Professional and Research Skills	12	7
BUQS3012A	Quantities and Specifications III	12	7
BUQS3013A	Construction Technology III	12	7
BUQS3014A	Estimating and Analysis of Prices	18	7
BUQS3015A	Management Principles in Construction	12	7
BUQS3016A	Building Science II	12	7
BUQS3018A	Introduction to Construction Management	12	7
BUQS3020A	Property Studies	12	7
CIVN3029A	Civil Engineering Theory II	7	7
CIVN3030A	Civil Engineering Theory III	7	7
LAWS2007A	Business Enterprise Law	24	6
A student shall also complete the following course to the satisfaction of the Senate:			
BUQS1994A	Practical Experience III	0	N/A

2.2.2.7 Curriculum Information for Bachelor of Science in Construction Studies (in the field of Property Studies)

Programme Code: FBA04		NQF Exit Level: 7	
Plan Code: FPACSS20		Total NQF Credits: 426	
Course Code	Course Description	NQF Credits	NQF Level
Year of Study I			
LAWS1000A	Commercial Law I	18	5
BUQS1007A	Communication Skills	18	5
ECON1012A or ECON1013A	Economics IA - Microeconomics	18	5
ECON1014A or ECON1015A	Economics IB - Macroeconomics	18	5

Course Code	Course Description	NQF Credits	NQF Level
MATH1039A	Mathematics for Property Studies	18	5
STAT1000A or STAT1001A or STAT1004A	Business Statistics	18	5
ARPL1010A	Planning for Property Developers	18	5
BUQS1009A	Real Estate Principles	18	5
Year of Study II			
BUQS2008A	Accounting Principles for Construction	18	6
BUQS2015A	Building Technology I	18	6
BUQS2009A	Econometrics for Property Studies	18	6
BUQS2014A	Real Estate Corporate Finance	36	6
BUQS2011A	Real Estate Market Analysis	18	6
BUQS2012A	Real Estate Law	18	6
BUQS2013A	Urban Economics	18	6
Year of Study III			
BUQS3027A	Building Technology II	18	7
BUQS3024A	Environmental Impact Assessment	18	7
BUQS3023A	Real Estate Finance	18	7
BUQS3022A	Real Estate Valuation	36	7
BUQS3026A	Building Services	18	7
BUQS3021A	Real Estate Management	18	7
BUQS3011A	Professional and Research Skills	12	7

2.2.2.8 Granting of Credit in BAS, BSc (Construction Studies), BSc (Construction Studies) in the field of Property Studies and BSc (Urban and Regional Planning)

1) Course divided into parts

Notwithstanding anything to the contrary contained in these rules, a *student* will not obtain *credit* in any *course* until s/he has successfully completed the syllabus prescribed for every part of the *course*. A *student* who has successfully completed one or more but not all of the parts of any such *course* may be exempted from re-attendance at and *re-examination* in such part or parts until the end of the *examination* session at the end of the following *academic year*.

2) Supplementary examination

A *student* who fails a *course* may be permitted, as specified in the faculty standing orders, to present himself/herself for a supplementary *examination* in that *course* except for the following *courses*:

ARPL1000A	Architectural Design and Theory I
ARPL1001A	Theory and Practice of Construction I
ARPL1015A	Introduction to Environmental Interpretation
ARPL1016A	Introduction to Settlement Form and Design

ARPL2000A	Architectural Design and Theory II
ARPL2002A	Theory and Practice of Construction II
ARPL2015A	Contemporary Design and Environmental Issues in South Africa
ARPL3005A	Architectural Design and Theory III
ARPL3033A	Local Planning and Urban Design
ARPL3034A	Integrated Development Planning
ARPL3031A	Theory and Practice of Construction III
ECON1002A	Economic Concepts IA
ECON1003A	Economic Concepts IB
ECON1012A	Economics IA – Microeconomics
ECON1014A	Economics IB – Macroeconomics
GEOG1003A	Geography for Planners
LAWS1000A	Commercial Law
LAWS2007A	Business Enterprise Law
POLS3017A	Liberty, Justice and the Politics of Difference
STAT1000A	Business Statistics

2.2.2.9 Granting of Credit

1) Bachelor of Engineering Science in Biomedical Engineering and Bachelor of Engineering Science in the field of Digital Arts

1.1) Aggregate

For the purposes of these rules an ‘aggregate’ is a weighted average of the final marks obtained in the group of *courses* contained in the *curriculum* for which a *student* is registered in any year of study in accordance with the *credits* prescribed by the rules and shown in parenthesis after each *course* in the *curricula*.

1.2) Unless otherwise provided for in the rules for a particular branch, the granting of credit for a course is determined as follows:

- a) A *student* who obtains the minimum aggregate as determined from time to time by the *Senate* and who in each *course* obtains the minimum mark, as determined from time to time by the *Senate*, may be granted *credit* in all the *courses* in her/his *curriculum*.
- b) A *student* who obtains the minimum aggregate but who fails to obtain the minimum mark in one or more *courses* may nevertheless be granted *credit* in all the *courses* in her/his *curriculum*. In deciding whether or not to grant *credit* in terms of this rule, the *Senate* may:

- i) require such a *student* to present himself/herself for an oral or other additional assessment in one or more or all of the *courses* in which s/he has failed to obtain the minimum mark,

or

- ii) permit such a *student* to present herself/ himself without further attendance for a supplementary *examination* in one or more or all of the *courses* which s/he has failed to pass **except** in the following *courses*:

ANAT2020A	Anatomy
APES1002A	Introductory Physiology & Environmental Sciences I
CHEM1012A	Chemistry I
HAEM2001A	Molecular and Cell Biology

MCBG1000A	Introductory Molecular and Cell Biology I
PHSL2004A	Physiology and Medical Biochemistry
WSOA1011A	Key Concepts in Game Design I
WSOA1012A	Key Concepts in Game Design II
WSOA2006A	Digital Art Design Project
WSOA2009A	Introduction to Game Creation II A
WSOA2010A	Introduction to Game Creation II B
WSOA3000A	Introduction to the World Wide Web as Creative Medium
WSOA3003A	Game Design III A
WSOA 3004A	Game Design III B

Courses taken from the Faculty of Humanities as electives in the first year of study.

2.2.3 Progression Rules

2.2.3.1 BAS, BSc (Construction Studies), BSc (Construction Studies) in the field of (Property Studies), BSc (Urban and Regional Planning), BEngSci (Biomedical Engineering) and BEngSci

- 1) A student will be admitted to the next year of study if –
 - i) s/he has obtained *credits* in all the *courses* prescribed; or
 - ii) s/he has obtained credit in all the courses shown in Table 2.2.3.1 for the appropriate year and *qualification*; and s/he has failed to obtain *credit* in no more than one of the other *courses* prescribed for that year of study.

Table 2.2.3.1

	2nd year	3rd year
BAS	ARPL1000A Architectural Design and Theory I ARPL1001A Theory and Practice of Construction	ARPL2000A Architectural Design and Theory II ARPL2002A Theory and Practice of Construction II
BSc (Construction Studies)	BUQS1006A Construction Technology I BUQS1008A Quantities and Specifications I	BUQS2004A Construction Technology II BUQS2005A Quantities and Specifications I
BSc (Construction Studies) in the field of Property Studies	STAT1000A Business Statistics	MATH1039A Mathematics for Property Studies
	MATH1039A Mathematics for Property Studies STAT1000A Business Statistics	BUQS2009A Econometrics for Property Developers BUQS2014A Real Estate Corporate Finance
	LAWS1000A Commercial Law I	BUQS2012A Real Estate Law

	2nd year	3rd year
	ECON1012A Economics 1A- Micro- Economics ECON1014A Economics 1B- Macro- Economics ARPL1010A Planning for Property Developers	BUQS2013A Urban Economics
	BUQS1009A Real Estate Principles MATH1039A Mathematics for Property Studies	BUQS2011A Real Estate Market Analysis
	BUQS3027A Building Technology II	BUQS2015A Building Technology I
	BUQS3021A Real Estate Management	BUQS2014A Real Estate Corporate Finance BUQS2011A Real Estate Market Analysis
	BUQS3022A Real Estate Valuation	BUQS2014A Real Estate Corporate Finance BUQS2011A Real Estate Market Analysis
	BUQS3023A Real Estate Finance	BUQS2014A Real Estate Corporate Finance
	BUQS3011A Professional and Research Skills	BUQS2009A Econometrics for Property Developers
BSc (Urban and Regional Planning)	ARPL1015A Introduction to Environmental Interpretation ARPL1016A Introduction to Settlement Form and Design	

- 2) A student who does not proceed to the next year of study in terms of 2.2.3.1 above, must include in her/his *curriculum* all the courses in which s/he failed to obtain *credit*. Subject to the prerequisites set out in 2.3 s/he may be permitted to include in her/his *curriculum* for that *academic year* such courses prescribed for the next year of study as the Senate may determine in her/his case, provided that the total number of credits prescribed for the year of study is not exceeded.
- 3) A student who is permitted to proceed to the next year of study in terms of 2.2.3.1 above without having obtained *credit* for all courses in her/his current year of study must include in her/his *curriculum* the course in which s/he failed to obtain *credit*.
- 4) A student who is registered for the BSc (Construction Studies) or the BSc (Construction Studies) in the field of Property Studies programme and who is permitted to proceed to the next year of study in terms of 2.2.3.1 (1.) (ii) must include in her/his *curriculum* the course in which s/he failed to obtain *credit*. Subject to the prerequisites set out in 2.3 s/he may exceed the total number of *credits* prescribed for the year of study to allow her/him to complete the full *curriculum* for her/his year of study.

- 5) **Condoned pass in selected courses (BSc Urban and Regional Planning)**
First year *students* registered for the first time, who fail the first *semester course* of the following pair of *courses* with a mark of between 40 and 49 percent, but pass the second *semester course* well enough that the total mark of the *courses* in the two *semesters* is over 50 percent, may receive a condoned pass for the *course* in the first *semester*:
ARPL1015A Introduction to Environmental Interpretation, and
ARPL1016A Introduction to Settlement Form and Design
- 6) **Repeating and substituting courses (BSc Urban and Regional Planning)**
A *candidate* for the BSc Urban and Regional Planning who fails any *course(s)* may repeat such *course(s)* or with special permission of the *Senate* substitute another *course(s)* for the *course(s)* that the *student* has failed.

2.2.3.2 Bachelor of Engineering Science (Biomedical Engineering) and Bachelor of Engineering Science in the field of Digital Arts

- 1) A *student* shall not be admitted to the second year of study unless s/he has obtained *credit* in all the *courses* prescribed for the first year of study and has satisfied all the other requirements prescribed by or determined in terms of these rules:
Provided that a *student* who has not obtained *credit* for all the qualifying *courses* prescribed for the first year, or who has not satisfied all the other requirements prescribed by or determined in terms of these rules may be permitted by the *Senate* to include in her/his *curriculum* in addition to the *courses* being repeated one or more of the *courses* prescribed for the second year, provided that the total number of *credits* prescribed for the year of study is not exceeded and is not restricted in terms of Rule G5.1, G6.2, G7.3 and 2.3.
- 2) Except where otherwise permitted in terms of these rules, a *student* shall not be admitted to the third year of study unless s/he has obtained *credit* in all the qualifying *courses* prescribed for the first two years of study and has satisfied all the other requirements prescribed by or determined in terms of these rules:
Provided that a *student* who has not obtained *credit* for all the *courses* prescribed for the first two years, or who has not satisfied all the other requirements prescribed by or determined in terms of these rules may be permitted by the *Senate* to include in her/his *curriculum* in addition to the remaining second year *courses* one or more of the *courses* offered for the third year, provided that the total number of *credits* prescribed for the year of study is not exceeded and is not restricted in terms of Rule G5.1, G6.2, G7.3 and 2.3.

2.2.3.3 Bachelor of Science in Engineering (all branches)

- 1) A *student* who fails MATH1042A with a mark between 40 and 49 percent, but passes MATH1043A well enough that the average mark for the two *courses* is 50 percent or above, may receive a condoned pass for MATH1042A.
- 2) A *student* who fails PHYS1032A with a mark between 40 and 49 percent, but passes PHYS1033A well enough that the average mark for the two *courses* is 50 percent or above, may receive a condoned pass for PHYS1032A.
- 3) A *student* who fails FEBE1002A with a mark between 40 and 49 percent, but passes FEBE1004A well enough that the average mark for the two *courses* is 50 percent or above, may receive a condoned pass for FEBE1002A.

2.2.4 Exclusion Rules

A *student* who does not meet the minimum requirements of study may be refused permission by the *Senate* to renew her/his registration. If however, a *student* is permitted to renew her/his registration after having failed to satisfy the minimum requirements of study, s/he may be required to satisfy these and further conditions as the *Senate* may determine in her/his case.

2.2.4.1 Bachelor of Architectural Studies

In all years of study a *student* must –

- a) pass every *course* that s/he is repeating; and
- b) obtain an aggregate (as defined in 2.1.3.3 (1.1) of at least 50% if registered for the first time in the first year; or
- c) obtain an aggregate as defined in 2.1.3.3 (1.1) of at least 45% if registered for the first year other than for the first time, or for second or third year.

2.2.4.2 Bachelor of Engineering Science (Biomedical Engineering) and Bachelor of Engineering Science in the field of Digital Arts

A *student* must –

- a) pass every *course* that s/he is repeating; and
- b) if registered for the first time in the first year, obtain *credit* in *courses* for which the total of the credits is a minimum of 60 percent of the total credits for the first-year *curriculum* of the *programme*; or
- c) if registered for the first year other than for the first time, or for second or third year obtain an aggregate as defined in 2.2.3.1 of a minimum of 45 percent.

2.2.4.3 Bachelor of Science (Construction Studies) and Bachelor of Science (Construction Studies) in the field of Property Studies

In all years of study a *student* must –

- a) pass every *course* that s/he is repeating; and
- b) obtain *credit* in *courses* for which the total of the credits is a minimum of 60 percent of the total credits for which s/he is registered.

2.2.4.4 Bachelor of Science in Urban and Regional Planning

In all years of study a *student* must –

- a) must pass any *course* which s/he may be repeating; and
- b) obtain *credit* in *courses* for which the total of the credits is a minimum of 60 percent of the total credits for which s/he is registered.

2.3 Prerequisite and corequisite rules*

***Includes information for Honours level courses for some programmes.**

1) Restriction on courses: prerequisite and corequisite requirements

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
FEBE1004A Engineering Analysis and Design IB	FEBE1000A and FEBE1002A	
School of Mathematics		
MATH1043A Engineering Mathematics 1A	MATH1042A	

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
MATH2026A	MATH1024A and MATH1043A	
School of Physics		
PHYS1033A Engineering Physics 1B	MATH1042A and PHYS1032A	MATH1043A
School of Architecture and Planning		
ARPL2000A Architectural Design and Theory II	ARPL1000A and ARPL1001A	
ARPL2002A Theory and Practice of Construction II	ARPL1000A and ARPL1001A	
ARPL2006A Planning for Housing Services, Infrastructure and Transport	APPM1023A	
ARPL2012A Histories and Theories of Architecture II	ARPL1027A or [ARPL1031A and ARPL1032A]	
ARPL2015A Contemporary Design and Environmental Issues in South Africa	[ARPL1015A and ARPL1016A and ARPL1014A] or ARPL1032A	
ARPL2019A Design Representation II	[ARPL1003 or ARPL1028A]	
ARPL2020A Digital Applications in Architecture II	[ARPL1003 or (ARPL1028A and ARPL1029A)]	
ARPL3005A Architectural Design and Theory III	[ARPL2000A and ARPL2002A]	
ARPL3033A Local Planning and Urban Design	[ARPL2015A and ARPL1025A and ARPL2013A]	ARPL3030A
ARPL3032A The Politics of Planning and Housing	ARPL2006A	
ARPL3021A Histories and Theories of Architecture III	ARPL2012A	
ARPL3034A Integrated Development Planning	ARPL2006A	[ARPL3027A and ARPL3028A]
ARPL3027A Regional Planning and Local Economic Development	[ECON1002A and ECON1003A]	
ARPL3028A Development Policy and Processes in South Africa	ARPL2006A	

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
ARPL3030A Applications in Graphic and Spatial Communication in Planning	[ARPL1025A and ARPL2015A]	
ARPL3031A Theory and Practice of Construction III	[ARPL2000A and ARPL2002A]	
School of Chemical and Metallurgical Engineering		
CHMT2017Introduction to Extractive Metallurgy		CHMT2018A
CHMT2018 Practical Metallurgy	[(FEBE1002A and FEBE1004A) and (PHYS1032A and (PHYS1033A)]	[CHMT2019A and CHMT2017A]
CHMT2019A Materials Science and Engineering	[PHYS1032A and (PHYS1033A)]	CHMT2018A
CHMT2021A Process Engineering Fundamentals A	[FEBE1002A and FEBE1004A]	
CHMT2023A Process Engineering Fundamentals B	[FEBE1002A and FEBE1004A]	CHMT2021A
CHMT2025A Process Engineering Fundamentals A	[FEBE1002A and FEBE1004A]	
CHMT3004A Chemical Engineering Laboratory	[CHMT2021A and CHMT2023A]	
CHMT3008A Numerical Methods (Chemical)	MATH2011A	
CHMT3014A Engineering Failure Analysis	CHMT2019A	
CHMT3019A Kinetic and Transport Process in Metallurgical Engineering	CHMT2017A	
CHMT3021A Solidification, Heat Treatment and Microstructure	CHMT2019A	
CHMT3024A Environmental Process Engineering	[CHMT2021A or CHMT2025A]	
CHMT3025A Crystal Structure and Analysis	CHMT2019A	
CHMT3027A Corrosion and Wear	CHMT2019A	
CHMT3028A Non-Ferrous Pyrometallurgy	[CHMT2017A and CHMT2018A]	[CHMT3046A and CHMT3047A]
CHMT3042A Chemical Reaction Engineering A	[CHMT2021A and CHMT2023A and MATH2011]	

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
CHMT3043A Chemical Reaction Engineering B	[CHMT2021A and CHMT2023A and MATH2011]	CHMT3042A
CHMT3041A Chemical Engineering Thermodynamics	[CHMT2021A and CHMT2023A]	CHMT3040A
CHMT3040A Applied Thermodynamics	[CHMT2021A and CHMT2023A]	
CHMT3038A Momentum and Heat Transport	[CHMT2021A and CHMT2023A and MATH2011]	
CHMT3039A Mass Transport and Operations	[CHMT2021A and CHMT2023A]	CHMT3038A
CHMT3046A Metallurgical Thermodynamics I	CHEM2018A	
CHMT3047A Metallurgical Thermodynamics II	CHMT3046A	
CHMT3048A Process and Materials Design I	All 1st and 2nd year courses	CHMT3049A
CHMT3049A Process and Materials Design II	All 1st and 2nd year courses	CHMT3048A
CHMT3044A Process Design Principles A	[CHMT2021A and CHMT2023A and MATH2011A]	
CHMT3045A Process Design Principles B	[CHMT2021A and CHMT2023A and MATH2011A]	CHMT3044A
CHMT4000A Hydrometallurgy	CHMT3024A	
CHMT4002A Physical Chemistry of Iron and Steel Manufacturing	[CHMT3046A and CHMT3047A]	
CHMT4003A Metallurgical Design	All 3rd year courses	
CHMT4004A Research Project	All 3rd year subjects	
CHMT4005A Management for Process Engineers	CHMT3024A	
CHMT4009A Chemical Engineering Design	All 3rd year courses	
CHMT4011A Process Control	[(CHMT3008A and CHMT3039A) or (CHMT3016A and CHMT3019A)]	
CHMT4015A Welding and Forming Processes	CHMT3021A	
CHMT4017A Structure and Properties of Engineering Materials	[CHMT3021A and CHMT3025A]	

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
CHMT4019A Chemical Engineering Research Project	All 3rd year courses	
CHMT4020A Hydrometallurgical Processes	[CHMT3024A and CHMT3026A]	
CHMT4032A Advanced Chemical Reaction Engineering	[CHMT3042A and CHMT3043A]	
School of Chemistry		
CHEM2017A Chemistry II	CHEM1031A	
CHEM2018A Chemistry II (Metallurgy)	CHEM1031A	
School of Civil and Environmental Engineering		
CIVN1005A Introduction to Civil Engineering Infrastructure	APPM1023A	
CIVN2018A Civil Engineering Theory I	[APPM1000A and ARPL1002A]	
CIVN2008A Materials and Structures I	PHYS1034A	
CIVN2009A Materials and Structures II	PHYS1034A	
CIVN2010A Numerical Methods	MATH1042A and MATH1043A	
CIVN2013A Introduction to Environmental Engineering	[CHEM1051A or CIVN2019A]	
CIVN3001A Construction Materials I	CIVN2009A	
CIVN3029A Civil Engineering Theory II	CIVN2018A	
CIVN3010A Structural Steel Design	CIVN2008A	
CIVN3011A Reinforced Concrete Design	CIVN2008A	
CIVN3024A Fluid Mechanics and Hydraulics	[MATH2011A or MATH2012A or MATH2026A]	
CIVN3025A Structural Analysis I	CIVN2008A	
CIVN3026A Structural Analysis II	CIVN2009A	
CIVN3019A Civil Engineering II (CS)	CIVN2018A Civil Engineering I	

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
CIVN4000A Construction Materials II	CIVN3001A	
CIVN4014A Structural Engineering	[CIVN3025A and CIVN3026A]	
CIVN4015A Civil Engineering Design	All 3rd year courses and a minimum number of CPD points from seminar attendance	
CIVN4004A Geotechnical Engineering II	CIVN3004A	
CIVN4005A Investigational Project	All 3rd year courses	
CIVN4010A Hydraulic Engineering	CIVN3024A	
School of Computer Science and Applied Mathematics		
APPM2017A Applied Mathematics IIA	PHYS1034A	
APPM3021A Computational Mathematics	MATH2014A	
APPM3037A Numerical Methods (Metallurgy)	MATH2012A	STAT3029A
School of Computer Science		
COMS2004A Data Structures and Algorithms	[MATH1042A and MATH1043A]	ELEN2004A
School of Construction Economics and Management		
CIVN2018A Civil Engineering Theory I	MATH1038A and PHYS1025A	
CIVN3029A Civil Engineering Theory II	CIVN2018A	
CIVN3030A Civil Engineering Theory III	CIVN2018A	
BUQS2003A Building Science I	PHYS1025A	
BUQS2004A Construction Technology II	BUQS1006A	
BUQS2005A Quantities and Specifications II	BUQS1008A	
BUQS2009 Econometrics for Property Studies	[MATH1039 and (STAT1000 or STAT1001 or STAT1004)]	
BUQS2011 Real Estate Market Analysis	[BUQS1009 and MATH1039]	

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
BUQS2012 Real Estate Law	LAWS1000	
BUQS2013 Urban Economics	[(ECON1012 or ECON1013) and (ECON1014 or ECON1015) and ARPL1010]	
BUQS2013A Urban Economics	[ECON1002A and ECON1003A]	
BUQS2014 Real Estate Corporate Finance	[MATH1039 and (STAT1000 or STAT1001 or STAT1004)]	
BUQS3011A Professional and Research Skills	BUQS1007A	
BUQS3012A Quantities and Specifications III	BUQS2005A	
BUQS3013A Construction Technology III	BUQS2004A	
BUQS3016A Building Science II	BUQS2003A	
BUQS3021 Real Estate Management	[BUQS2011 and BUQS2014]	
BUQS3022 Real Estate Valuation	[BUQS2011 and BUQS2014]	
BUQS3023 Real Estate Finance	BUQS2014	
BUQS3027 Building Technology II	[BUQS1006 or BUQS2015]	
BUQS4033 Entrepreneurship and Innovation	BUQS4035	
BUQS4034 Advanced Real Estate Valuation	BUQS3022	
BUQS4036 Commercial Real Estate Investments	BUQS3023	
BUQS4037 Corporate Real Estate	BUQS3021	
BUQS4038 Real Estate Development	[BUQS2011 and BUQS3023 and BUQS3024]	
BUQS4039 Facilities Management	[(BUQS2003 or BUQS3026) and (BUQS2004 or BUQS3027) and BUQS3021]	
BUQS4041 Research Report	BUQS3011	

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
School of Electrical and Information Engineering		
ELEN2000A Electrical Engineering	[(MATH1042A and MATH1043A) and (PHYS1032A and PHYS1033A) or PHYS1025A]]	[MATH2011A or MATH2012A]
ELEN2003A Electric and Magnetic Systems	[(MATH1042A and MATH1043A) and (PHYS1032A and PHYS1033A)]	ELEN2017A
ELEN2004A Software Development I	[(MATH1042A and MATH1043A) and (PHYS1032A and PHYS1033A)]	ELEN2017A
ELEN2020A Software Development I	[(MATH1042A and MATH1043A) and (PHYS1032A and PHYS1033A)]	ELEN2017A
ELEN2005A Signs and Systems I	[MATH1014A and (MATH1042A or MATH1043A) and PHYS1014A and PHYS1032 and PHYS1033]	ELEN2017A
ELEN2006A Microprocessors	[MATH1042A and MATH1043A]	[(ELEN2004A and ELEN2016A) or (COMS1015A and COMS1018A)]
ELEN2016A Electronics I	[(MATH1042A and MATH1043A) and (PHYS1032A and PHYS1033A)]	ELEN2017A
ELEN2017A Electric Circuits	[(MATH1042A and MATH1043A) and (PHYS1032A and PHYS1033A)]	
ELEN3000A Electromagnetic Engineering	MATH2014A	MATH3025A
ELEN3002A Electronics II	[ELEN2005A and ELEN2016A and MATH2014A]	
ELEN3003A Power Engineering	[ELEN2003A and MATH2014A]	
ELEN3007A Probabilistic System and Signal Analysis	MATH2014A	[APPM3021A or MATH3025A]
ELEN3008A Biomedical Measurement and Instrumentation	[ELEN2005A and ELEN2016A]	
ELEN3009A Software Development II	[ELEN2004A and ELEN2006A]	
ELEN3012A Signals and Systems II A	[ELEN2005A and MATH2014A]	

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
ELEN3013A Signals and Systems II B	[ELEN2004A and ELEN2005A and MATH2014A]	ELEN3012A
ELEN3014A Biomedical Signals, Systems and Control	ELEN2005A	[ELEN3012A and PHSL2004A]
ELEN3015A Data and Information Management	[ELEN2004A and ELEN2005A]	APPM3012A
ELEN3016A Control I	[ELEN2005A and MATH2014A]	[ELEN3012A and ELEN3013A]
ELEN3017A Electrical Engineering Design		[(ELEN3002A and ELEN3012A and ELEN3013A and ELEN3016A and ELEN3009A and ELEN3007A) and dependent on option chosen: (ELEN3000A and ELEN3003A) or (ELEN3015A and ELEN3024A)]
ELEN3018A Economics of Design	[ELEN2004A and ELEN2016A]	
ELEN3024 Communication Fundamentals	ELEN2005A	[ELEN3007A and ELEN3012A]
ELEN4000A Electrical Engineering Design II	All 3rd year courses (Electrical option)	
ELEN4001A High Frequency Techniques	[ELEN3000A and MATH3025A]	
ELEN4002A Electrical Engineering Laboratory	All 3rd year courses (Electrical option)	
ELEN4003A High Voltage Engineering	[ELEN3000A and ELEN3003A]	
ELEN4006A Measurement Systems	[ELEN3002A and ELEN3007A and ELEN3012A]	
ELEN4009A Software Engineering	ELEN3009A	
ELEN4010A Software Development III	ELEN3009A	
ELEN4011A Information Engineering Design	All 3rd year courses (Info option)	
ELEN4012A Information Engineering Laboratory	All 3rd year courses (Info option)	

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
ELEN4014A Electromechanical Conversion	ELEN3003A	
ELEN4016A Control II	[ELEN3012A and ELEN3013A and ELEN3016A]	
ELEN4017A Network Fundamentals	ELEN3024A	
ELEN4018A Power Systems	[ELEN3000A and ELEN3003A]	
ELEN4020A Data Intensive Computing in Data Science	ELEN3009A	
ELEN4023A Renewable Energy	ELEN3003A	
School of Geosciences		
GEOL2027A Geology for Civil Engineers	[PHYS1015A or PHYS1034A]	
School of Mathematics		
MATH2011A Mathematics II	[MATH1042A and MATH1043A]	
MATH2012A Mathematics II	[MATH1042A and MATH1043A]	
MATH2014A Mathematics II	[MATH1042A and MATH1043A]	
MATH2026A Mathematics II	[MATH1042A and MATH1043A]	
MATH3025 Mathematical Methods (Electrical)	MATH2014A	
MATH3026A Mathematical Methods (Aero and Mech)	MATH2026A	
MATH3036A Mathematical Methods (Industrial)	[MATH2011A or MATH2012A or MATH2014A or MATH2026A]	
School of Mechanical Industrial and Aeronautical Engineering		
MECN1999A Vacation Work (Mechanical)	MECN1998A	
MECN1996A Engineering Professional Activity	All third-year courses within the registered programme	MECN4005A
MECN2022A Fluid Mechanics	[(MATH1042A and MATH1043A) and (PHYS1032A and PHYS1033A)]	[MECN2005A and MECN2011A]
MECN2005A Mechanical Engineering Laboratory I	[PHYS1032A and PHYS1033A]	[MECN2022A and MECN2024A and MECN2010A and MECN2011A and MECN2013A]

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
MECN2024A Engineering Thermodynamics	[(MATH1042A and MATH1043A) and (PHYS1032A and PHYS1033A)]	MECN2005A
MECN2010A Introduction to Materials Science and Engineering	[CHEM1051A and FEBE1004A and (PHYS1032A and PHYS1033A)]	
MECN2011A Applied Mechanics A	[(MATH1042A and MATH1043A) and FEBE1002A and PHYS1034A]	[MECN2013A and MECN2025A and MECN2026A]
MECN2012A Computing Skills and Software Development	[(MATH1042A and MATH1043A) and FEBE1004A]	
MECN2013A Applied Mechanics B	[(MATH1042A and MATH1043A) and FEBE1002A and PHYS1034A]	[MECN2011A and MECN2025A and MECN2026A]
MECN2025A Engineering Design	[FEBE1002A and FEBE1004A and PHYS1034A]	[MECN2022A and MECN2024A and MECN2011A and MECN2013A and MECN2010A and MECN2026A]
MECN3003A Aeronautical Engineering Investigation	[MECN2022A and MECN2005A and MECN2024A and MECN2011A and MECN2013A]	[MECN3035A and MECN3036A and MECN3008A and MECN3012A and MECN3027A]
MECN2026A Machine Elements	[FEBE1002A and FEBE1004A and PHYS1034A]	[MECN2022A and MECN2024A and MECN2011A and MECN2013A and MECN2010A and MECN2026A and MECN2025A]
MECN3004A Industrial Engineering Design		MECN3014A and MECN3028A

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
MECN3038A Aeronautical Engineering Design	[MECN2010A and MECN2025A and MECN2026A] or MECN2014A	[MECN3035A and MECN3036A and MECN3008A and MECN3027A and MECN3028A and MECN3043A]
MECN3042A Industrial Engineering Investigation		[MECN3012A and MECN3014A and MECN3025A and MECN3028A and MECN3030A]
MECN3041A Mechanical Engineering Investigation	[MECN2005A and MECN2011A and MECN2022A and MECN2024A] and [MECN2013A or PHYS2001A]	[MECN3036A and MECN3010A and MECN3012A and MECN3037A and MECN3027A]
MECN3008A Introduction to Aeronautics	[MATH2011A and MECN2022A and MECN2011A and MECN2013A]	[MECN3038A and MECN3035A]
MECN3010A Mechanics of Solids I	MECN2011A or MECN2019A	MECN3039A
MECN3012A Mechatronics	[ELEN2000A (students articulating into Industrial Engineering from Civil Engineering will be required to cover the material in their own time) and (MECN2012A or CHMT2011A or CIVN1001A or CIVN2014A or ELEN2004A or MINN2000A or MINN2020A) and (PHYS1034A or PHYS1025A or (PHYS1032A and PHYS1033A))]	[MATH3026A or MATH3036A] and [MECN3038A or MECN3004A or MECN3039A] and [MECN3003A or MECN3006A or MECN3007A]
MECN3013A Business Management		[MECN3004A or MECN3038A or MECN3039A]
MECN3014A Operations Management: Techniques		MECN3030A
MECN3039A Mechanical Engineering Design	[MECN2013A and MECN2014A] or [MECN2025A and MECN2026A] and MECN2010A and MECN2011A	[MECN3036A and MECN3010A and MECN3037A and MECN3027A and MECN3028A and MECN3043A]

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
MECN3025A Manufacturing Technology: Processes		MECN3006A
MECN3027A Mechanical Vibrations	[MECN2013A or PHYS2001A]	MATH3026A
MECN3028A Engineering in its Social Context		[MECN3004A or MECN3038A or MECN3039A]
MECN3030A Operations Research	[MATH2011A or MATH2012A or MATH2014A or MATH2026A]	MATH3036A
MECN3031A Mathematical Topics (Industrial)	[MATH2011A or MATH2012A or MATH2014A or MATH2026A]	MATH3036A
MECN3032A Numerical Methods and Statistics	MATH2011A	
MECN3035A Aircraft Structures I	MECN2011A	[MECN3038A and MECN3008A]
MECN3036A Incompressible Flows	[MECN2022A and MECN2013A]	[MATH3026A and MECN3038A or MECN3039A]
MECN3037A Fundamentals of Heat Transfer	MECN2024A	[MECN3007A and MECN3039A and MATH3026A]
MECN3043A Manufacturing Processes	[(MECN2010A or MECN2016A) and MECN2014A] or [MECN2025A and MECN2026A]	MECN3038A or MECN3039A
MECN4005A Design Project	All 3rd year courses	All 4th year courses
MECN4006A Research Project	All 3rd year courses	All 4th year courses
MECN4009 Manufacturing Technology: Systems	MECN3025A	
MECN4015A Business Studies	[MECN3004A and MECN3013A]	
MECN4020A Systems Management and Integration		[MECN4005A or MECN4006A or ELEN4002A or ELEN4012A]
MECN4023A Mechanics of Solids II	MECN3010A	
MECN4024A Gas Dynamics and Propulsion	MECN3036A	MECN4025A
MECN4025A Aerodynamics	[MATH3026A and MECN3036A and MECN3008A]	[MECN4024A and MECN4026A]
MECN4026A Flight Dynamics	[MECN3008A and MECN3027A]	MECN4025A
MECN4027A Aircraft Structures II	[MECN3035A and MECN3027A]	

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
MECN4028A Decision Support and Intelligence Systems	[MECN3030A and MATH3036A]	
MECN4029A Mechatronics II	[MATH3026A and MECN3012A and MECN3027A]	
MECN4030A Operations Management: Systems Integration	[MECN3014A and MECN3031A]	MECN4020A
MECN4031A Compressible Flows	MECN3036A	MECN4032A
MECN4032A Energy Conversion and Utilisation Systems	[MATH3026A and MECN3007A and MECN3037A]	MECN4031A
School of Mining Engineering		
MINN2006A Engineering Services for Mining	PHYS1034A	
MINN2014A Mechanical Excavation of Rock	PHYS1034A	
MINN2020A Computer Programming for Mining	MINN2024A	
MINN3015A Mine Transportation, Automation and Robotics	[MINN2006A or an equivalent course]	
MINN3016A Mineral Resources Evaluation	[MATH2026A or an equivalent Mathematics Major course]	
MINN3018A Rock Mechanics	[MATH2026A or an equivalent Mathematics Major course]	
MINN3019A Mine Ventilation and Climate Control	[MATH2026A or an equivalent Mathematics Major course]	
MINN3021A Mine Surveying and Geospatial Techniques	[MINN2016A or an equivalent Engineering Surveying course]	
MINN3022A Underground Mining Systems	[MINN2008A or an equivalent Mining Methods course]	
MINN3023A Surface Mining Systems	[MINN2008A or an equivalent Mining Methods course]	
MINN4014A Mine Design	All 3rd year courses	
MINN4015A Project Report	[All 3rd year courses and midyear SP requirements]	

A. Course	B. Prerequisite	C. Corequisite
BSc Engineering (all branches)		
MINN4016A Rock Engineering	MINN3018A Rock Mechanics	
MINN1995A Mine Technical Visits	All 3rd year courses	
MINN7044A Research Project	MINN7094 Research Methods for Mining Engineers	
School of Physics		
PHYS2007A Physics II (Electrical)	[(PHYS1032A and PHYS1033A) and (MATH1042A and MATH1043A)]	
School of School of Statistics and Actuarial Sciences		
STAT1000 / STAT1004 Business Statistics	MATH1039	
STAT3029A Engineering Statistics	MATH2012A	APPM3037A

3 POSTGRADUATE

3.1 Diplomas

Qualification Name	Programme Code	NQF Exit Level
Postgraduate Diploma in Engineering (in various Branches): PGDip (Eng)	EXA00	8
Postgraduate Diploma in Planning	FXA03	8
Postgraduate Diploma in Property Development and Management: PGDip PDM	FXA02	8

3.1.1 Admission Rules

3.1.1.1 Postgraduate Diploma in Engineering

Any of the following may be admitted by the *Senate* as a *candidate* for the diploma, provided that s/he has attained such standard as the *Senate* may require for this purpose, or that s/he submits evidence of postgraduate work of a standard considered satisfactory by the *Senate* –

- provided that the *Senate* has determined that the academic discipline in which her/his first degree was obtained is relevant to the *programme of courses* which s/he wishes to undertake, a Bachelor of Science with Honours or a Bachelor of Science in Town and Regional Planning, or a Bachelor of Science in Building, of this or any other University; or, in exceptional circumstances and with the special permission of the *Senate*, a person holding another Honours *qualification* of this or any other university; or
- a person who has obtained at any other university or institution such awards as, in the opinion of the *Senate*, are equivalent to or higher than the BSc (Eng) at this University; or
- a person other than a graduate who has in any other manner satisfied the *Senate* that s/he is so qualified.

3.1.1.2 Postgraduate Diploma in Planning

Any of the following may be admitted by the *Senate* as a *candidate* for the PGDip Planning –

- a) a recognised undergraduate degree in a cognate field such as geography, architecture, engineering, sociology, anthropology, economics, politics, and property studies, etc.; or
- b) *candidates* with a BTech in Urban and Regional Planning; or
- c) *candidates* with a BTech in other fields; or
- d) *candidates* with a national diploma in Urban, Rural and Regional Planning and a minimum of six years of experience in planning practice.

3.1.1.3 Postgraduate Diploma in Property Development and Management

Any of the following may be admitted by the *Senate* as a *candidate* for the PGDip PDM:

- a) a Bachelor of Architecture or a Bachelor of Architectural Studies or a Bachelor of Science in Quantity Surveying or in Urban and Regional Planning or in Building or Construction Management or a Bachelor of Science in Engineering in the branch of Civil Engineering of this *University*; or
- b) a Bachelor of Commerce of the *University* who has passed three *courses* in Economics or Business Economics or a minimum of two *courses* in one of these subjects and two *courses* in another subject which in the opinion of the *Senate* is cognate to the study of property development and management; or
- c) a person who in any other manner has satisfied the *Senate* that s/he is so qualified.

3.1.2 Curricula

3.1.2.1 Length of Curriculum

1) Postgraduate Diploma in Engineering

The *curriculum* for the diploma in one of the branches of engineering in which a bachelor's *qualification* may be obtained, or in a field therein as determined from time to time, shall extend over not less than one *academic year* of full-time study or two *academic years* of part-time study. A *candidate* shall not be registered in any year of study until her/his *curriculum* for that year of study has been approved by the *Senate*.

An approved *curriculum* may be amended only with the consent of the *Senate*.

An approved *curriculum* for a part-time *candidate* for any year of study will normally consist of a minimum of three but not more than five *courses*.

2) Postgraduate Diploma in Planning

The *curriculum* for the diploma shall extend over not less than one *academic year* of full-time study or two *academic years* of part-time study.

3) Postgraduate Diploma in Property Development and Management

The *curriculum* for the diploma shall extend over not less than two *academic years* of part-time study.

3.1.2.2 Curricula for the Postgraduate Diploma in Engineering (all branches)

A *candidate* for the Postgraduate Diploma in Engineering must follow an approved *curriculum* consisting of core and elective *courses* with credits yielding not fewer than 120 credits. In the case of a *candidate* who selects one or more *courses* offered by another discipline, a minimum of 80 *credits* shall be derived from *courses* offered in the discipline of Engineering and not more than 40 shall be derived from *courses* offered by other disciplines.

Any course chosen from another faculty is subject to prior approval by the Graduate Studies Committee.

1) Branch of Aeronautical Engineering:

Programme Code: EXA00		NQF Exit Level: 8	
Plan Code: EFAAERO50		Total NQF Credits: 120	
Course Code	Course Description	NQF Credits	NQF Level
The following courses are prescribed:			
MECN5008A	Aerodynamics	20	8
MECN5009A	Flight Dynamics and Control	20	8
MECN5010A	Aircraft Structures	20	8
MECN5011A	Compressible Flow and Propulsion	20	8
MECN5005A	Systems Management	20	8
MECN5007A	Engineering Investigation	20	8

2) Branch of Chemical Engineering:

2.1) In the field of Oil and Gas Engineering

Programme Code: EXA00		NQF Exit Level: 8	
Plan Code: EFACHM50		Total NQF Credits: 120	
Course Code	Course Description	NQF Credits	NQF Level
The following courses are prescribed:			
CHMT5006A	Introduction to Petroleum and Offshore Operations Coal Sampling and Quality Assessment	20	8
CHMT5007A	Petroleum Reservoir and Production Engineering Coal Management and Marketing	20	8
CHMT5008A	Drilling and Completion Engineering with laboratory Coal Combustion and Power Generation	20	8
CHMT5009A	Risk Management and Sustainable Development in Oil & Gas Engineering, Coal Preparation and Beneficiation	20	8
CHMT5010A	Natural Gas Production and Oilfield Processing Coal Conversion and Gasification	20	8
CHMT5011A	Oil and Gas Engineering Projects Coal and Carbon in the Metallurgy Industry	20	8
CHMT5012A	Vacation/Industrial Training (Oil & Gas Engineering)	0	N/A

2.2) *In the field of Chemical Engineering*

Programme Code: EXA00		NQF Exit Level: 8	
Plan Code: EFACHM50		Total NQF Credits: 120	
Course Code	Course Description	NQF Credits	NQF Level
The following <i>courses</i> are prescribed:			
CHMT5025A	Process Engineering Fundamentals A	20	8
CHMT5026A	Process Engineering Fundamentals B	20	8
CHMT5027A	Biochemical Engineering with Industrial Applications	20	8
CHMT5028A	Risk Management and Sustainable Development in Chemical Engineering	20	8
CHMT5029A	Chemical Engineering Investigational Project A	20	8
CHMT5030A	Chemical Engineering Investigational Project B	20	8

3) **Branch of Electrical Engineering:**

Programme Code: EXA00		NQF Exit Level: 8	
Plan Code: EFAELE50		Total NQF Credits: 120	
Course Code	Course Description	NQF Credits	NQF Level
A combination of <i>courses</i> listed below yielding 120 credits:			
ELEN5000A	Measurement Systems	20	8
ELEN5001A	High Frequency Techniques	20	8
ELEN5002A	High Voltage Engineering	20	8
ELEN5003A	Software Engineering	20	8
ELEN5004A	Software Development	20	8
ELEN5005A	Electromechanical Conversion	20	8
ELEN5006A	Network Fundamentals	20	8
ELEN5007A	Control II	20	8
ELEN5008A	Power systems	20	8
ELEN5009A	Database Systems	20	8
ELEN5010A	Introduction to Software Engineering	20	8
ELEN5011A	Selected Topics in Software Engineering	20	8
ELEN5012A	Software Development Methodologies, Analysis and Design	20	8
ELEN5013A	Software Project Management	20	8
ELEN5014A	Software Technologies and Techniques	20	8
ELEN5016A	Electric and Hybrid Vehicles	20	8
ELEN5017A	Distribution System Engineering	20	8
ELEN5015A	Transmission System Engineering	20	8

Course Code	Course Description	NQF Credits	NQF Level
ELEN5035A	Renewable Energy	20	8
Provided that the Senate may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other postgraduate diploma <i>courses</i> at an NQF level 8 that are relevant to the field of study.			

4) Branch of Engineering Management

Programme Code: EXA00	NQF Exit Level: 8
Plan Code: EFAENMN50	Total NQF Credits: 120

Course Code	Course Description	NQF Credits	NQF Level
The following <i>courses</i> are prescribed:			
MECN5002A	Operations Management	20	8
MECN5016A	Accounting and Financial Statements in Engineering	20	8
MECN5017A	Lean Management	20	8
MECN5005A	Systems Management	20	8
MECN5006A	Business Planning Studies	20	8
MECN5007A	Engineering Investigation	20	8

5) Branch of Industrial Engineering:

Programme Code: EXA00	NQF Exit Level: 8
Plan Code: EFAIND50	Total NQF Credits: 120

Course Code	Course Description	NQF Credits	NQF Level
The following <i>courses</i> are prescribed:			
MECN5002A	Operations Management	20	8
MECN5003A	Operations Research Methods	20	8
MECN5004A	Manufacturing Technology Principles	20	8
MECN5005A	Systems Management	20	8
MECN5006A	Business Planning Studies	20	8
MECN5007A	Engineering Investigation	20	8

6) Branch of Mechanical Engineering:

Programme Code: EXA00	NQF Exit Level: 8
Plan Code: EFAMEC50	Total NQF Credits: 120

Course Code	Course Description	NQF Credits	NQF Level
The following <i>courses</i> are prescribed:			
MECN5013A	Thermal System	20	8
MECN5014A	Fluid Dynamics	20	8

Course Code	Course Description	NQF Credits	NQF Level
MECN5015A	Mechatronics	20	8
MECN5012A	Mechanics of Solids	20	8
MECN5007A	Engineering Investigation	20	8
MECN5005A	Systems Management	20	8

7) Branch of Metallurgy and Materials Engineering:

Programme Code: EXA00	NQF Exit Level: 8
Plan Code: EFAMET50	Total NQF Credits: 120

6.1) In the field of Metallurgy

Course Code	Course Description	NQF Credits	NQF Level
The following courses are prescribed:			
CHMT5000A	Introduction to Extractive Metallurgy	20	8
CHMT5001A	Metallurgical Process Modelling & Design	20	8
CHMT5002A	Extractive Metallurgy Investigative Project	20	8
CHMT5003A	Principles of Hydrometallurgy	20	8
CHMT5004A	Principles of Mineral Processing	20	8
CHMT5005A	Principles of Pyrometallurgy	20	8

6.2) In the field of Welding Design

Course Code	Course Description	NQF Credits	NQF Level
The following courses are prescribed:			
CHMT5013A	Design and Construction of Welded Structures under Static Loading	20	8
CHMT5014A	Design and Construction of Welded Structures under Dynamic Loading	20	8
CHMT5015A	Practical Education Welding and Fabrication Processes	20	8
CHMT5016A	Fabrication Applications Engineering	20	8
CHMT5017A	Non-Destructive Testing Methods and Economics	20	8
CHMT5018A	Case Studies for Welding Engineers	20	8

6.3) In the field of Welding Metallurgy

Course Code	Course Description	NQF Credits	NQF Level
The following courses are prescribed:			
CHMT5019A	Welding Metallurgy of Steels	20	8
CHMT5020A	Weldability of Alloy Steels and Stainless Steels	20	8
CHMT5021A	Weldability of Ferrous and Non-Ferrous Materials	20	8

Course Code	Course Description	NQF Credits	NQF Level
CHMT5022A	Welding Processes and Equipment	20	8
CHMT5023A	Other Welding Processes	20	8
CHMT5024A	Advanced Welding Processes	20	8

6.4) In the field of Welding Process

Course Code	Course Description	NQF Credits	NQF Level
A combination of courses listed below yielding 120 credits:			
CHMT5022A	Welding Processes and Equipment	20	8
CHMT5023A	Other Welding Processes	20	8
CHMT5024A	Advanced welding processes	20	8
CHMT5015A	Practical Education Welding and Fabrication Processes	20	8
CHMT5016A	Fabrication Applications Engineering	20	8
CHMT5017A	Non-Destructive Testing Methods and Economics	20	8
CHMT5018A	Case Studies for Welding Engineers	20	8

Note: not all courses are offered every year

3.1.2.3 Curriculum for Postgraduate Diploma in Planning

Programme Code: FXA03	NQF Exit Level: 8
Plan Code: FPAPLN70	Total NQF Credits: 150

Course Code	Course Description	NQF Credits	NQF Level
The following courses are prescribed:			
ARPL5004A	Cities, Development and Planning	20	8
ARPL5005A	Spatial Planning, Transport and Infrastructure	30	8
ARPL5007A	Technologies and Techniques of Planning	10	8
ARPL5008A	Planning, Environment and Sustainability	20	8
ARPL5009A	Urban and Regional Economic Development	20	8
ARPL5010A	Integrated Development Planning	20	8
ARPL5011A	Planning Law	20	8
ARPL5012A	Professional Practice and Ethics	10	8
Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other courses that are relevant to the field of planning.			
The Senate may exempt a candidate from any course (or courses) on the grounds of her/his having obtained credit in the same or similar course; provided that such credits do not exceed 50 percent of the credits yielded by the coursework requirements of the diploma.			

3.1.2.4 Curriculum for Postgraduate Diploma in Property Development and Management

Programme Code: FXA02	NQF Exit Level: 8
PLAN CODE: FFAPDM72	Total NQF Credits: 150

1) In the field of Property Development and Management

Course Code	Course Description	NQF Credits	NQF Level
The following <i>courses</i> are prescribed:			
BUQS5021A	Law for Property Development and Management I	10	8
BUQS5022A	Law for Property Development and Management II	10	8
BUQS5023A	Real Estate Market Analysis	10	8
BUQS5024A	Real Estate Valuation	10	8
BUQS5025A	Quantitative Methods for Property Studies	20	8
BUQS5026A	Commercial Real Estate Investments	10	8
BUQS5027A	Applied Macroeconomics	10	8
BUQS5028A	Real Estate Finance	10	8
BUQS5029A	Real Estate Development	10	8
BUQS5030A	Real Estate Brokerage	10	8
BUQS5031A	Real Estate and Asset Management	20	8
BUQS5032A	Management and Leadership for the Property Sector	20	8

Programme Code: FXA02	NQF Exit Level: 8
PLAN CODE: FFAPDM73	Total NQF Credits: 150

2) In the field of Facilities Management

Course Code	Course Description	NQF Credits	NQF Level
The following <i>courses</i> are prescribed:			
Year of Study I			
BUQS5023A	Real Estate Market Analysis	10	8
BUQS5026A	Commercial Real Estate Investment	10	8
BUQS5028A	Real Estate Finance	10	8
BUQS5033A	Introduction to Facilities Management	10	8
BUQS5034A	Building Services	10	8
BUQS5035A	Strategic Planning	10	8
BUQS5036A	Commercial/Procurement Law	10	8
BUQS5037A	Space and Workplace Management	10	8
Year of Study II			
BUQS5031A	Real Estate and Asset Management	20	8
BUQS5038A	Information Technology in Facilities Management	10	8

Course Code	Course Description	NQF Credits	NQF Level
BUQS5039A	Project Management in Facilities Management	10	8
BUQS5040A	Environmental Management	10	8
BUQS5041A	Occupational Health and Safety	10	8
BUQS5042A	Advanced Facilities Management	10	8

3.1.2.5 Prerequisite courses for Postgraduate Diploma in Property Development and Management

Except with the permission of the *Senate*, a person admitted as a *student* for the diploma may not proceed to a *course* listed under (A) below unless s/he has obtained *credit* in or been exempted from the prerequisite *course* listed under (B) below.

A. Course	B. Prerequisite	C. Corequisite
BUQS5024A Real Estate Valuation	BUQS5026A	
BUQS5035A Strategic Planning	BUQS5033A	
BUQS5026A Commercial Real Estate Investment	BUQS5028A	
BUQS5038A Information Technology in Facilities Management	[BUQS5033A, BUQS5034A and BUQS5037A]	
BUQS5042A Advanced Facilities Management	[BUQS5033A and BUQS5031A and BUQS5037A and	
	BUQS5035A and BUQS5038A and BUQS5039A and BUQS5040A]	
BUQS5031A Real Estate and Asset Management	BUQS5026A	

3.1.3 Progression Rules for Postgraduate Diploma in Property Development and Management

- a) A *student* will be admitted to the next year of study within the two-year part-time study if –
 - i) s(he) has obtained all the *credits* in all the *courses* prescribed; or
 - ii) s(he) has obtained *credits* in all the *courses* shown in 32.11 / 32.13 above for the appropriate year and *qualification*; and
 - iii) s(he) has failed to obtain *credit* in no more than one of the other *courses* prescribed for that year of study.
- b) A *student* who does not proceed to the next year of study in terms of a), b) and c) above, must include in her/his *curriculum* all the *courses* in which s/he failed to obtain *credit*. Subject to the prerequisites set out in 32.13, s/he may be permitted to include in her/his *curriculum* for that *academic year* such *courses* prescribed for the next year of study as the *Senate* may determine in her/his case
- c) A *student* who is permitted to proceed to the next year of study in terms of a), b) and c) above without having obtained *credit* for all *courses* in her/his current year of study must include in her/his *curriculum* the *course* in which s/he failed to obtain *credit*.

3.1.4 Completion Rules

3.1.4.1 Postgraduate Diploma in Engineering

1) Conditions for award of diploma

A *candidate* for the diploma shall attend and pass *courses* approved by the *Senate* yielding 120 *credits*. A *candidate* may be required to register for undergraduate *courses*, for which no *credit* shall be given.

A *candidate* who fails to pass any *course* (or *courses*) may repeat any such *course* (or *courses*) or substitute another *course* (or *courses*) for it but may not obtain more than 60 *credits* either by repeating *courses* or substituting *courses* or both, unless the *Senate* otherwise determines in a case considered by it to be exceptional.

2) Exemptions

The *Senate* may exempt a *candidate* from any of the *courses* on the ground of her/his having obtained *credit* in the same or a similar *course* whether in the *University* or elsewhere; provided that such *credits* do not exceed one third of the total requirements for the diploma.

3.1.4.2 Postgraduate Diploma in Planning

1) Conditions for the award of diploma

A *candidate* is required to pass *courses* included in the *curriculum* yielding a minimum of 150 *credits*.

2) Repeating and substituting courses

A *candidate* for the Postgraduate Diploma in Planning who fails any *course* (or *courses*) may repeat such *course* (or *courses*), or with special permission of the *Senate* substitute another *course* (or *courses*) for the *course(s)* that the *candidate* has failed.

A *candidate* may not fail a repeat *course* or *courses* yielding more than 40 *credits*. If a *candidate* has failed *courses* yielding 40 *credits* or more altogether, her/his registration for the diploma may be cancelled unless the *Senate* is satisfied that there are exceptional circumstances.

3.1.4.3 Postgraduate Diploma in Property Development and Management

1) Completion and repetition of courses

A *candidate* for the Postgraduate Diploma in Property Development and Management who fails any *course(s)* may repeat such *course(s)*, or with special permission of the *Senate* substitute such *course(s)*.

A *candidate* may not fail a repeat *course* or fail more than three *courses*. Such *candidates'* registration for the diploma may be cancelled unless the *Senate* is satisfied that there are exceptional circumstances.

3.2 General Degrees

Qualification Name		Programme Code	NQF Exit Level
Bachelor of Architectural Science Honours – BASHons		FHA00	8
Bachelor of Science Honours (in various branches) – BScHons	Construction Management	FHA05	8
	Quantity Surveying	FHA06	8
	Urban and Regional Planning	FHA04	8

3.2.1 Admission Rules

3.2.1.1 Bachelor of Architectural Studies Honours

Any of the following persons may be admitted by the *Senate* as a *candidate* for the *qualification* –

- a) a holder of the Bachelor of Architectural Studies of this or another university who has attained such standard as the *Senate* may from time to time determine; or
- b) a holder of the four-year Bachelor of Technology in Architectural Design who has attained such standard as the *Senate* may from time to time determine.

3.2.1.2 Bachelor of Science Honours in Urban and Regional Planning

Any of the following persons may be admitted by the *Senate* as a *candidate* for the *qualification* –

- a) a holder of the Bachelor of Urban and Regional Planning of this or another university who has attained such standard as the *Senate* may from time to time determine; or
- b) a holder of the four-year Bachelor of Technology in Town Planning who has attained such standard as the *Senate* may from time to time determine.

3.2.1.3 Bachelor of Science Honours in Construction Management

Any of the following persons may be admitted by the *Senate* as a *candidate* for the *qualification* –

- a) a holder of the Bachelor of Science in Construction Management Studies or the Bachelor of Science in Construction Studies of this or another university who has attained such standard as the *Senate* may from time to time determine; or
- b) a holder of the four-year Bachelor of Technology in Construction Management who has attained such standard as the *Senate* may from time to time determine.

3.2.1.4 Bachelor of Science Honours in Quantity Surveying Studies

Any of the following persons may be admitted by the *Senate* as a *candidate* for the *qualification*:

- a) a holder of the Bachelor of Science in Quantity Surveying Studies or the Bachelor of Science in Construction Studies of this or another university who has attained such standard as the *Senate* may from time to time determine;
- b) a holder of the four-year Bachelor of Technology in Quantity Surveying who has attained such standard as the *Senate* may from time to time determine.

3.2.2 Curricula

3.2.2.1 Bachelor of Architectural Studies Honours

Programme Code: FHA00		NQF Exit Level: 8	
Plan Code: FPABAS40		Total NQF Credits: 180	
Course Code	Course Description	NQF Credits	NQF Level
ARPL4000A	Advanced Design Studio	45	8
ARPL4001A	Design Studio	45	8
ARPL4002A	Contemporary Architectural Theory	18	8
ARPL4003A	Advanced Theory and Practice of Construction	18	8
ARPL4004A	Advanced History of Architecture and Urbanism	18	8
ARPL4005A	Research Project	36	8

3.2.2.2 Bachelor of Science Honours in Construction Management

Programme Code: FHA05		NQF Exit Level: 8	
Plan Code: FPACM41		Total NQF Credits: 142	
Course Code	Course Description	NQF Credits	NQF Level
BUQS4026A	Construction Law	17	8
BUQS4027A	Construction Project Management	17	8
BUQS4028A	Simulated Project	17	8
BUQS4029A	Advanced Construction Management	17	8
BUQS4030A	Advanced Building Science	17	8
BUQS4031A	Research Report	39	8
CIVN4016A	Civil Engineering Theory in Construction	18	8
A student shall also complete the following course to the satisfaction of the Senate:			
BUQS1990A	Practical Training	0	N/A

3.2.2.3 Bachelor of Science Honours in Quantity Surveying

Programme Code: FHA06		NQF Exit Level: 8	
Plan Code: FPAQS41		Total NQF Credits: 141	
Course Code	Course Description	NQF Credits	NQF Level
BUQS4022A	Simulated Project	17	8
BUQS4023A	Dispute Resolution	17	8
BUQS4024A	Cost Evaluation and Control	17	8
BUQS4025A	Advanced Theory and Practice of Quantity Surveying IV	17	8
BUQS4026A	Construction Law	17	8
BUQS4027A	Construction Project Management	17	8
BUQS4031A	Research Report	39	8
A student shall also complete the following course to the satisfaction of the Senate:			
BUQS1991A	Practical Training	0	N/A

3.2.2.4 Bachelor of Science Honours in Urban and Regional Planning

Programme Code: FHA04		NQF Exit Level: 8	
Plan Code: FPAURP41		Total NQF Credits: 150	
Course Code	Course Description	NQF Credits	NQF Level
The following courses are prescribed:			
ARPL4014A	Advanced Planning Thought	20	8
ARPL4027A	Integrated Planning Project	30	8
ARPL4028A	Research Design for Planners	10	8
ARPL4029A	Research Report	60	8

Programme Code: FHA04		NQF Exit Level: 8	
Plan Code: FPAURP41		Total NQF Credits: 150	
Course Code	Course Description	NQF Credits	NQF Level
ARPL4030A	Planning Law	20	8
ARPL4031A	Professional Practice and Ethics	10	8
Provided that the Senate may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other honours <i>courses</i> relevant to the field of planning.			

3.2.2.5 Progression Rules BASHons, BScHons (Construction Management), BScHons (Quantity Surveying) and BScHons (Urban and Regional Planning)

Except with the permission of the Senate, a *student* who fails to obtain *credit* in the Research Project and who is permitted to repeat the *course* shall be required to select a new topic approved by the Senate.

3.2.2.6 Progression Rules BScHons (Urban and Regional Planning)

1) Credits previously obtained

The Senate may exempt a *candidate* from any *course* (or *courses*) on the grounds of her/his having obtained *credit* in the same or similar *course*; provided that such *credits* do not exceed 50 percent of the *credits* yielded by the coursework requirements of the degree.

2) Repeating and substituting courses

A *candidate* who fails any *course/s* may be permitted to repeat such *course* (or *courses*), or with special permission of the Senate substitute another *course* (or *courses*) for the *courses* that the *candidate* has failed. A *candidate* may not fail a repeat *course* or *courses* yielding more than 40 *credits*. If a *candidate* has failed *courses* yielding 40 *credits* or more altogether, her/his registration for the degree may be cancelled unless the Senate is satisfied that there are exceptional circumstances.

3.3 Masters Degrees

Programme Name	Programme Code	NQF Exit Level
Master of Architecture (Professional): MArch (Prof) by Coursework and Research Report	FCA02	9
Master of Architecture: MArch by Research	FRA00	9
Master of Science in Building: MSc (Building) by Research by Coursework and Research Report	FRA03 FCA11	9
Master of Science in Development Planning: MSc (Development Planning) by Coursework and Research Report	FCA15	9
Master of Science in Engineering: MSc (Engineering) by Research by Coursework and Research Report	ERA00 ECA00	9
Master of Science in Aeronautical Engineering: MSc (Aeronautical Engineering) by Research by Coursework and Research Report	ERA02 ECA02	9

Programme Name	Programme Code	NQF Exit Level
Master of Science in Engineering Management: MSc (Engineering Management) by Research by Coursework and <i>Research Report</i>	ERA04 ECA04	9
Master of Science in Industrial Engineering: MSc (Industrial Engineering) by Research by Coursework and <i>Research Report</i>	ERA06 ECA06	9
Master of Science in Mechanical Engineering: MSc (Mechanical Engineering) by Research by Coursework and <i>Research Report</i>	ERA05 ECA05	9
Master of Science in Systems Engineering: MSc (Systems Engineering) by Research by Coursework and <i>Research Report</i>	ERA07 ECA07	9
Master of Science in Bulk Materials Handling: MSc (Bulk Materials Handling) by Research by Coursework and <i>Research Report</i>	ERA03 ECA03	9
Master of Engineering Professional: MEng by Coursework and <i>Research Report</i>	ECA01	9
Master of Science in Urban and Regional Planning: MSc (Urban and Regional Planning) by Research	FRA02	9
Master of Science in Quantity Surveying: MSc (Quantity Surveying) by Research	FRA01	9
Master of Urban Design: MUD by Coursework and <i>Research Report</i>	FCA13	9
Master of Urban Studies: MUS by Coursework and <i>Research Report</i>	FCA16	9

3.3.1 Rules applicable to Masters

3.3.1.1 Research in organisations outside the University

The *Senate* may permit a *candidate* to conduct advanced study and research in terms of 3.1.3 (A), or undertake her/his Research Report in terms of 3.1.3 (B), at an institution outside the *University* which has been specially recognised by the *Senate* for this purpose.

3.3.1.2 Credits previously obtained

The *Senate* may exempt a *candidate* from any of the *courses* on the grounds of her/his having obtained *credit* in the same or a similar *course*, at this *University* or another university. In accordance with Rule G4.7.1 a *credit* is not granted more than once.

3.3.1.3 Further assessment

Any *candidate* shall, if required by the *Senate*, present himself/herself for such further assessment in regard to the subject of her/his Dissertation or *Research Report* as the *Senate* may determine.

3.3.2 Admission Rules

For *admission* to a *programme* leading to a *higher qualification* the *Senate* must be satisfied that the *candidate* is qualified at an appropriate standard to undertake the proposed line of study or research or both. Subject to the provisions of Rule G4.11.1, G4.11.4 and G4.11.6 a *candidate* with the qualifications listed in 3.1.2.1 – 3.1.2.12 may be admitted to candidature for the appropriate *qualification* of master.

3.3.2.1 Master of Architecture (Professional)

BAS(Hons) of this *University* or the equivalent.

3.3.2.2 Master of Architecture

- a) BArch of this *University* or the equivalent;
- b) BAS (Hons) of this *University* or the equivalent.

3.3.2.3 Master of Nuclear Leadership Technology

- a) BSc Eng of this *University* or an honours or equivalent in Engineering;
- b) An *applicant* who does not meet the requirements listed above, must meet a minimum of one of the following requirements as listed in the faculty standing orders on higher degrees:
 - i) An M-Tech with at least three years appropriate professional experience in the relevant field;
 - ii) A four year non-engineering degree with at least three years appropriate professional experience in the relevant field;
 - iii) A B-Tech (includes a T5 qualification from previous Technikons) with at least three years appropriate professional experience in the relevant field;
 - iv) A three year non-engineering degree with at least six years appropriate professional experience in the relevant field;
 - v) A National Higher Diploma (NHDip) (includes a T4 or S4 qualification from previous Technikons) with at least six years appropriate professional experience in the relevant field;
 - vi) A National Diploma (ND) (includes a T3 or S3 qualification from previous Technikons) with at least ten years appropriate professional experience in the relevant field;
- c) Applicants should also have a strong nuclear physics or nuclear engineering background.

3.3.2.4 Master of Science in Building

- a) BSc(Building) or BSc(Construction Management) of this *University* or the equivalent;
- b) BArch or BSc(Town and Regional Planning) or BSc (Hons) (Urban and Regional Planning), or MArch(Prof) or BSc(Property Studies), or BSc(Quantity Surveying), or BSc (Eng) in the branch of Civil Engineering of this *University* or the equivalent;
- c) BSc(Hons) (Economics) or BCom(Hons) or BSc(Hons) (Finance) of this *University* or the equivalent.

3.3.2.5 Master of Science in Development Planning

- a) A BSc (Hons)(Urban and Regional Planning) at a sufficient standard;
- b) PGDip (Development Planning) with an average of a minimum of 60 percent.

3.3.2.6 Master of Science in Engineering / Master of Engineering (Professional) in all branches / Master of Science in Aeronautical Engineering, Bulk Materials Handling, Engineering Management, Mechanical Engineering, Industrial Engineering and Systems Engineering

- a) BSc (Eng) of this *University* or the equivalent;
- b) Postgraduate Diploma in Engineering
- c) BSc with Honours or a BSc (Town and Regional Planning) or BSc (Hons) (Urban and Regional Planning), or BSc (Building) or a BSc (Quantity Surveying), of this *University* or the equivalent;
- d) In exceptional circumstances and with special permission of the *Senate*, another Honours degree of this or any other university.

3.3.2.7 Master of Science in Urban and Regional Planning

- a) BSc (Town and Regional Planning) or BSc (Hons) (Urban and Regional Planning) of this *University* or the equivalent;
- b) BSc with Honours of this *University* or the equivalent;
- c) Bachelor's degree and in addition a HDip(Development Planning) or a PGDip (Planning) of this *University* or the equivalent.

3.3.2.8 Master of Science in Quantity Surveying

- a) BSc(Quantity Surveying) of this *University* or the equivalent.

3.3.2.9 Master of Urban Design

- a) BArch of this *University* or the equivalent;
- b) BAS (Hons) of this *University* or the equivalent;
- c) MArch (Prof) of this *University* or the equivalent;
- d) BSc (Town and Regional Planning) or BSc (Hons) (Urban and Regional Planning) of this *University* or the equivalent;
- e) A person who has in any other manner satisfied the *Senate* that s/he is so qualified.

3.3.2.10 Master of Urban Studies

- a) BSc (Town and Regional Planning) or BSc (Hons) (Urban and Regional Planning) of this *University* or the equivalent;
- b) BAS (Hons) of this *University* or the equivalent;
- c) BA (Hons) in a relevant social science or humanities discipline (political studies, sociology, history, anthropology, development studies, geography);
- d) PGDip (Planning) of this *University*;
- e) A person who has in any other manner satisfied the *Senate* that s/he is so qualified.

3.3.3 Curricula

a) Masters by Research

See Rule G9 - G9.4

b) Masters by Coursework and Research Report

3.3.3.1 Length of Curriculum

The length of the *curriculum* extends over no fewer than the number of *academic years* indicated in Table 3.1.3.1.

Table 3.1.3.1 (f/t = full time; p/t = part time)

MArch (Prof)	M NTL	MSc (Building)	MSc (DP)	MSc (Eng)
1f/t or 2p/t	1f/t or 2p/t	1f/t or 2p/t	1f/t or 2p/t	1f/t or 2p/t
MSc (Aeronautical Engineering)	MSc (Engineering Management)	MSc (Industrial Engineering)	MSc (Mechanical Engineering)	MSc (Systems Engineering)
1f/t or 2p/t	1f/t or 2p/t	1f/t or 2p/t	1f/t or 2p/t	1f/t or 2p/t
MSc (Bulk Materials Handling)	MEng (Prof)	MUD	MUS	
1f/t or 2p/t	1f/t or 2p/t	1f/t or 2p/t	1f/t or 2p/t	

3.3.3.2 Requirements for the qualification of master by Coursework and Research Report

For all the *qualifications* listed in 3.1.3.1 a *candidate* must attend and by *examination* pass the *courses* detailed in the appropriate *curriculum* and submit to the satisfaction of the *Senate* a *Research Report* (or in the case of MArch (Prof) an architectural design and discourse) on a topic approved by the *Senate*.

3.3.3.3 Curriculum Information for Master of Architecture (Professional)

Programme Code: FCA02		NQF Exit Level: 9	
Plan Code: FPAARC60		Total NQF Credits: 180	
Course Code	Course Description	NQF Credits	NQF Level
The <i>courses</i> listed below are prescribed:			
ARPL7001A	Advanced Digital Applications	9	9
ARPL7002A	Simulated Office Practice	45	9
ARPL7003A	Architectural Design and Discourse	90	9
ARPL7041A	Architectural Professional Practice	36	9

3.3.3.4 Curriculum Information for Master of Science in Building

- 1) A *candidate* may proceed in either of the specialised fields of Project Management in Construction or Property Development and Management.
- 2) The *curriculum* of a *candidate* must be approved by the *Senate* and must comprise a *programme* of *courses* yielding 180 *credits*.
- 3) For the purposes of these rules, the Research Report in 3.4.3.3 (5 & 6) hereof shall be deemed to be a *course*, which report must be conducted under the direction of a supervisor approved by the *Senate* and which would in the opinion of the *Senate* require not less than four months of full-time research. A *candidate* must successfully complete the Research Methodology course before being permitted to register for the Research Report.
- 4) A *candidate* must register for a minimum of three *courses* in each year of study, except in a case where a *candidate* requires only one *course* or two *courses* to complete the requirements for the qualification.

5) In the specialised field of Project Management in Construction

Programme Code: FCA11		NQF Exit Level: 9	
Plan Code: FFAPMC61		Total NQF Credits: 180	
Course Code	Course Description	NQF Credits	NQF Level
The following <i>courses</i> are prescribed:			
BUQS7009A	Research Methodology	20	9
BUQS7022A	Construction Law and Contract Management	20	9
BUQS7024A	Project Management	20	9
BUQS7025A	Construction Planning and Control	20	9
BUQS7026A	Construction Economics and Finance	20	9
BUQS7037A	Construction Safety and Quality Management	20	9
BUQS7027A	<i>Research Report</i> in the field of Project Management in Construction	60	9

6) In the specialised field of Property Development and Management

Programme Code: FCA11		NQF Exit Level: 9	
Plan Code: FFAPDM60		Total NQF Credits: 180	
Course Code	Course Description	NQF Credits	NQF Level
The following <i>courses</i> are prescribed:			
BUQS7009A	Research Methodology	20	9
BUQS7028A	Real Estate Finance	10	9
BUQS7029A	Real Estate Development	10	9
BUQS7030A	Real Estate Market Analysis	10	9
BUQS7031A	Real Estate Law	10	9
BUQS7032A	Property Valuation	10	9
BUQS7033A	Applied Macroeconomics	10	9
BUQS7034A	Advanced Topics in Real Estate Studies	10	9
BUQS7035A	Commercial Real Estate Investments	10	9
BUQS7036A	Quantitative Methods for Property Studies	20	9
BUQS7027A	<i>Research Report</i> in the field of Property Development and Management	60	9

3.3.3.6 Curriculum Information for Master of Science in Development Planning

Programme Code: FCA15		NQF Exit Level: 9	
Plan Code: FPADP63		Total NQF Credits: 180	
Course Code	Course Description	NQF Credits	NQF Level
a) The following <i>courses</i> are prescribed			
ARPL7029A	Philosophies, Theories and Methodologies of Development Planning	20	9
ARPL7063A	Governance and Municipal Planning	20	9
ARPL7044A	Community Participation in Urban Governance: Discourses, Theories and Practices	20	9
ARPL7040A	Research Methods	10	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more masters <i>courses</i> that are relevant to the field of Development Planning.			
c) Subject to the approval of the <i>Senate</i> , a <i>candidate</i> must, select an elective <i>course</i> that is at the level of master at this University and which is relevant to the field of Development Planning, yielding a minimum of 20 <i>credits</i> .			
d) A <i>candidate</i> must successfully complete a <i>Research Report</i> (ARPL7064A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of Development Planning.			
e) In exceptional circumstances, a <i>candidate</i> , who in the opinion of the <i>Senate</i> , lacks the necessary skills relating to development planning which are covered in the Postgraduate Diploma(Planning) may be required to complete up to three <i>courses</i> from the Postgraduate Diploma (Planning).			

1) Repeating and substituting courses

- a) A *candidate* who fails a compulsory *course* may be permitted to repeat such *course* once; a *candidate* who fails an elective *course* may be permitted either to repeat such *course* or to select an alternative elective *course*.
- b) A *candidate* may not fail more than one *course* or fail a repeat *course*.
- c) In exceptional circumstances the *Senate* may permit a *candidate* who has submitted a *Research Report* that is not satisfactory to submit a new report on a different topic.

3.3.3.7 Master of Science in Engineering

For the Master of Science in Engineering a *candidate* shall complete a *programme* approved by the *Senate* of advanced coursework and a *Research Report* (which shall be deemed to be a *course* for the purpose of these rules), in one of the branches of engineering in which a bachelor's degree may be obtained or in a field within such a branch as determined by the *Senate* from time to time.

An approved *curriculum* will comprise a *programme* yielding 180 *credits* -

- a) coursework yielding 90 *credits* -
 - i) a combination of four *courses* yielding 20 *credits* each and one *course* yielding 10 *credits*; or
 - ii) in the branch of Civil Engineering, five *courses* yielding 20 *credits* each; and
- b) a *Research Report* yielding 90 *credits*.

A *candidate* may be required in terms of Rule G4.11.4 to register for undergraduate *courses*, for which no *credit* shall be obtained.

The *Research Report* yielding 90 credits must be conducted under the direction of a supervisor approved by the *Senate*, and must, in the opinion of the *Senate*, require not less than the equivalent of six months of full-time work.

1) Branch of Chemical Engineering

Programme Code: ECA00	NQF Exit Level: 9
Plan Code: EFACHM60	Total NQF Credits: 180

1.1) *In the field of Advanced Chemical Engineering*

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding 80 credits:			
CHMT7035A	Process Flow Sheet Synthesis	20	9
CHMT7036A	Reactor Synthesis	20	9
CHMT7037A	Distillation Synthesis	20	9
CHMT7079A	Applied Chemical Engineering Thermodynamics	20	9
CHMT7039A	Applied Optimization	20	9
CHMT7040A	Experimental Process Synthesis	20	9
CHMT7072A	Advanced Biochemical Engineering	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other masters <i>courses</i> that are relevant to the field of study.			
c) Successfully complete a Research Methodology CHMT7077A <i>course</i> yielding a minimum of 10 credits at an NQF level 9 and a <i>Research Report</i> (CHMT7008A) yielding 90 credits at an NQF level 9 on a topic appropriate to the field Chemical Engineering.			

1.2) *In the field of Petroleum, Oil and Gas Engineering*

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding 80 credits:			
CHMT7070A	Nanotechnology in Petroleum Reservoir	20	9
CHMT7062A	The Future of the Automotive Industry and Fuels	20	9
CHMT7063A	Process Instrumentation and Control in Refining	20	9
CHMT7064A	Introduction to Oil and Gas Production Corrosion	20	9
CHMT7065A	Oil Products and Refining	20	9
CHMT7066A	Introduction to Oil and Gas Offshore Platforms/Pipelines	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other masters <i>courses</i> that are relevant to the field of study.			
c) Successfully complete a Research Methodology CHMT7077A <i>course</i> yielding a minimum of 10 credits at an NQF level 9 and a <i>Research Report</i> (CHMT7008A) yielding 90 credits at an NQF level 9 on a topic appropriate to the field Petroleum, Oil and Gas Engineering.			

1.3) In the field of Coal Science and Technology

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding 80 <i>credits</i> :			
CHMT7005A	Coal Sampling and Quality Assessment	20	9
CHMT7006A	Coal Management and Marketing	20	9
CHMT7057A	Coal Combustion and Power Generation	20	9
CHMT7058A	Coal Preparation and Beneficiation	20	9
CHMT7059A	Coal Conversion and Gasification	20	9
CHMT7060A	Coal and Carbon in the Metallurgical Industry	20	9
CHMT7068A	Underground Coal Gasification	20	9
CHMT7069A	Carbon Capture in Power Plants	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other masters <i>courses</i> that are relevant to the field of study.			
c) Successfully complete a Research Methodology CHMT7077A <i>course</i> yielding a minimum of 10 <i>credits</i> at an NQF level 9 and a <i>Research Report</i> (CHMT7008A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field Petroleum, Oil and Gas Engineering.			

1.4) In the field of Clean Energy & Sustainable Technologies

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding 80 <i>credits</i> :			
CHMT7039A	Applied Optimisation	20	9
CHMT7059A	Coal Conversion and Gasification	20	9
CHMT7065A	Oil Products and Refining	20	9
CHMT7068A	Underground Coal Gasification	20	9
CHMT7069A	Carbon Capture in Power Plants	20	9
CHMT7076A	Synthetic Fuels & Processes	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other masters <i>courses</i> that are relevant to the field of study.			
c) Successfully complete Research Methodology CHMT7077A <i>course</i> yielding a minimum of 10 <i>credits</i> at an NQF level 9 and a <i>Research Report</i> (CHMT7008A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field Coal Science and Technology.			

2) Branch of Civil Engineering

Programme Code: ECA00	NQF Exit Level: 9
Plan Code: EFACIV60	Total NQF Credits: 180

The *curriculum* for all the fields of study in the branch of Civil Engineering, require *courses* taken from a), b), c) and the table of elective *courses* listed below:

2.1) In the field of Geotechnical and Materials Engineering

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed in below yielding a minimum of 40 <i>credits</i> :			
CIVN2023A	Deep Foundations and Anchors	20	9
CIVN7028A	Earth Pressures and Retaining Structures	20	9
CIVN7072A	Analytic Methods in Geomechanics	20	9
CIVN7071A	Critical State Soil Mechanics	20	9
CIVN7021A	Advanced Geotechnical Site Investigation	20	9
CIVN7022A	Advanced Geotechnical Site Investigation	20	9
CIVN7027A	Theoretical Soil Mechanics	20	9
CIVN7074A	Management of Tailings Storage Facilities	20	9
b) Three <i>courses</i> selected from the list of elective <i>courses</i> under 2.6) below as may be offered in any year.			
c) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other masters <i>courses</i> that are relevant to the field of study.			
d) Successfully complete a <i>Research Report</i> (CIVN7019A) yielding 90 credits at an NQF level 9 on a topic appropriate to the field of Water Engineering.			

2.2) In the field of Water Engineering

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed in below yielding a minimum of 40 <i>credits</i> :			
CIVN7016A	Hydraulic Structures	20	9
CIVN7035A	River Hydraulics	20	9
CIVN7058A	Rural Water Supply and Sanitation	20	9
CIVN7059A	Water Management	20	9
CIVN7060A	Hydraulic Modelling	20	9
CIVN7061A	Water Supply and Urban Drainage	20	9
CIVN7065A	Water Resources Planning	20	9
b) Three <i>courses</i> selected from the list of elective <i>courses</i> under 2.6) below as may be offered in any year			
c) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other masters <i>courses</i> that are relevant to the field of study.			
d) Successfully complete a <i>Research Report</i> (CIVN7019A) yielding 90 credits at an NQF level 9 on a topic appropriate to the field of Water Engineering.			

2.3) In the field of Structural Engineering

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed in below yielding a minimum of 40 <i>credits</i> :			
CIVN7000A	Non-linear Analysis of Structures	20	9
CIVN7005A	Dynamic Loading and Analysis of Structures	20	9
CIVN7012A	Advanced Design of Structural Steel	20	9
CIVN7026A	Analysis and Design of Shell Structures	20	9
CIVN7036A	Finite Element Analysis of Structures	20	9
CIVN7046A	Advanced Prestressed Concrete Design	20	9
CIVN7047A	Advanced Reinforced Concrete Design	20	9
CIVN7062A	Design of Masonry Structures	20	9
b) Three <i>courses</i> selected from the list of elective <i>courses</i> under 2.6) below as may be offered in any year			
c) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other masters <i>courses</i> that are relevant to the field of study.			
d) Successfully complete a <i>Research Report</i> (CIVN7019A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of Structural Engineering.			

2.4) In the field of Infrastructure Engineering and Management

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding a minimum of 40 <i>credits</i> :			
CIVN7006A	Employment Creation in Road Construction and Maintenance	20	9
CIVN7007A	Employment Creation in Construction & Maintenance of Infrastructure	20	9
CIVN7018A	Project Management in Construction	20	9
CIVN7020A	Project Management in Developing Areas	20	9
CIVN7025A	Construction Site Management	20	9
CIVN7029A	Urban Engineering Context	20	9
CIVN7030A	Science and Technology Policy for Development	20	9
CIVN7038A	Project Management - Part 1	20	9
CIVN7039A	Project Management - Part 2	20	9
CIVN7073A	Transport Modelling and Analysis	20	9
b) Three <i>courses</i> selected from the list of elective <i>courses</i> under 2.6) below as may be offered in any year			
c) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other masters <i>courses</i> that are relevant to the field of study.			
d) Successfully complete a <i>Research Report</i> (CIVN7019A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of Project and Construction Management.			

2.5) In the field of Environmental Engineering

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding a minimum of 40 <i>credits</i> :			
CIVN7013A	Wastewater Engineering	20	9
CIVN7024A	Environmental Management	20	9
CIVN7033A	Water Quality Modelling	20	9
CIVN7044A	Pollution Prevention and Abatement	20	9
CIVN7045A	GIS Applications in Environmental Planning, Management and Decision-Making	20	9
CIVN7051A	Introduction to Industrial Ecology	20	9
CIVN7053A	Design for the Environment	20	9
CIVN7054A	Air Resources Engineering	20	9
CIVN7068A	Environmental Engineering Design	20	9
CIVN7069A	Managing the Environmental Impact of a Nuclear Project	20	9
CIVN7075A	Sustainability for the Built Environment	20	9
b) Three <i>courses</i> selected from the list of elective <i>courses</i> under 2.6) below as may be offered in any year			
c) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other Master's <i>courses</i> that are relevant to the field of study.			
d) Successfully complete a <i>Research Report</i> (CIVN7019A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of Environmental Engineering.			

2.6) Elective courses for all fields of study in the Branch of Civil Engineering:

Course Code	Course Description	NQF Credits	NQF Level
CIVN7000A	Non-Linear Analysis of Structures	20	9
CIVN7005A	Dynamic Loading and Analysis of Structures	20	9
CIVN7006A	Employment Creation in Road Construction and Maintenance	20	9
CIVN7007A	Employment Creation in Construction & Maintenance of Infrastructure	20	9
CIVN7012A	Advanced Design of Structural Steel	20	9
CIVN7013A	Wastewater Engineering	20	9
CIVN7016A	Hydraulic Structures	20	9
CIVN7018A	Project Management in Construction	20	9
CIVN7020A	Project Management in Developing Areas	20	9
CIVN7023A	Deep Foundations and Anchors	20	9
CIVN7024A	Environmental Management	20	9
CIVN7025A	Construction Site Management	20	9
CIVN7026A	Analysis and Design of Shell Structures	20	9

Course Code	Course Description	NQF Credits	NQF Level
CIVN7028A	Earth Pressures & Retaining Structures	20	9
CIVN7029A	Urban Engineering Context	20	9
CIVN7030A	Science and Technology Policy for Development	20	9
CIVN7033A	Water Quality Modelling	20	9
CIVN7035A	River Hydraulics	20	9
CIVN7036A	Finite Element Analysis of Structures	20	9
CIVN7038A	Project Management - Part 1	20	9
CIVN7039A	Project Management - Part 2	20	9
CIVN7042A	Select Topics - Civil Engineering	20	9
CIVN7044A	Pollution Prevention and Abatement	20	9
CIVN7045A	GIS Applications in Environmental Planning, Management and Decision-Making	20	9
CIVN7051A	Introduction to Industrial Ecology	20	9
CIVN7053A	Design for the Environment	20	9
CIVN7054A	Air Resources Engineering	20	9
CIVN7068A	Environmental Engineering Design	20	9
CIVN7069A	Managing the Environmental Impact of a Nuclear Project	20	9
CIVN7071A	Critical State Soil Mechanics	20	9
CIVN7072A	Analytic Methods in Geomechanics	20	9
CIVN7073A	Transport Modelling and Analysis	20	9
CIVN7075A	Sustainability for the Built Environment	20	9

3) Branch of Electrical Engineering

Programme Code: ECA00	NQF Exit Level: 9
Plan Code: EFAELE60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding 80 <i>credits</i> :			
ELEN7059A	Principles of Communications Systems	20	9
ELEN7015A	Teletraffic Engineering	20	9
ELEN7064A	Principles of Wireless Communication/LTE	20	9
ELEN7062A	Coding Techniques and Telecommunications	20	9
ELEN7011A	Selected Topics in Telecommunications	20	9
ELEN7044A	Introduction to Software Engineering	20	9
ELEN7055A	Database Systems	20	9

Course Code	Course Description	NQF Credits	NQF Level
ELEN7045A	Software Development Methodologies, Analysis & Design	20	9
ELEN7046A	Software Technologies and Techniques	20	9
ELEN7047A	Software Project Management	20	9
ELEN7012A	Selected Topics in Software Engineering	20	9
ELEN7009A	Principles of Insulation Coordination in	20	9
ELEN7018A	Earthing and Lightning Protection	20	9
ELEN7043A	Advanced Electromechanical Conversion	20	9
ELEN7048A	Variable Speed Drives for AC Machines	20	9
ELEN7056A	Power Electronics	20	9
ELEN7013A	Selected Topics in Power Engineering	20	9
ELEN7079A	Applied Quantum Computing	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other Master's <i>courses</i> that are relevant to the field of study.			
c) Successfully complete a Research Methods in Engineering/Research Methodology <i>course</i> yielding a minimum of 10 <i>credits</i> at an NQF level 9 and a <i>Research Report</i> (ELEN7000A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of Electrical Engineering.			

4) Branch of Mechanical, Industrial and Aeronautical Engineering

Programme Code: ECA00	NQF Exit Level: 9
Plan Code: EFAMIA61	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding 80 <i>credits</i> :			
MECN7005A	Engineering Economics	20	9
MECN7029A	Mathematical Topics for Engineering Management	20	9
MECN7006A	Production and Ops Management	20	9
MECN7017A	Value Engineering and Analysis	20	9
MECN7023A	Management of Technology	20	9
MECN7117A	Lean Operations	20	9
MECN7057A	Enterprise Engineering	20	9
MECN7059A	Supply Chain Management	20	9
MECN7065A	Service Engineering	20	9
MECN7001A	Reliability Engineering	20	9
MECN7024A	Maintenance Engineering	20	9
MECN7026A	Finite Element Methods	20	9
MECN7034A	Bulk Solids Storage and Handling	20	9
MECN7035A	Belt Conveying of Bulk Solids	20	9

Course Code	Course Description	NQF Credits	NQF Level
MECN7054A	Systems Engineering: Hard Systems Methodologies	20	9
MECN7058A	Systems Engineering: Soft Systems Methodologies	20	9
MECN7062A	Systems Engineering: An Overview	20	9
MECN7114A	Operations Strategy	20	9
MECN7118A	Machine Learning for Engineers	20	9
CIVN7038A	Project Management – Part I	20	9
CIVN7039A	Project Management – Part II	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other <i>Master's courses</i> at an <i>NQF level 9</i> that are relevant to the field of study.			
c) Successfully complete a Research Methods in Engineering course (MECN7066A) yielding a minimum of 10 <i>credits</i> at an <i>NQF level 9</i> and a <i>Research Report</i> (MECN7018A) yielding 90 <i>credits</i> at an <i>NQF level 9</i> on a topic appropriate to the field of Industrial, Mechanical Engineering or Aeronautical Engineering.			

5) Branch of Mechanical in the field of Nuclear Technology Leadership

Programme Code: ECA00	NQF Exit Level: 9
Plan Code: EFANTL60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding 80 <i>credits</i> :			
MECN7067A	Financial modelling for nuclear energy projects	20	9
ELEN7066A	Global trends and sustainability	20	9
MECN7068A	Leadership of nuclear strategy	20	9
CIVN7069A	Managing the environmental impact of a nuclear energy project	20	9
MECN7069A	Regulation and security of nuclear energy projects	20	9
MECN7070A	Strategic management of the nuclear energy projects Lifecycle	20	9
b) Successfully complete a Research Methods in Engineering course (MECN7066A) yielding a minimum of 10 <i>credits</i> at an <i>NQF level 9</i> and a <i>Research Report</i> (MECN7018A) yielding 90 <i>credits</i> at an <i>NQF level 9</i> on a topic appropriate to the field Nuclear Technology Leadership.			

6) Branch of Metallurgy and Materials Engineering

Programme Code: ECA00	NQF Exit Level: 9
Plan Code: EFAMET60	Total NQF Credits: 180

6.1) in the field of Coal Science and Technology

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding 80 <i>credits</i> :			
CHMT7005A	Coal Sampling and Quality Assessment	20	9
CHMT7006A	Coal Management and Marketing	20	9
CHMT7057A	Coal Combustion and Power Generation	20	9
CHMT7058A	Coal Preparation and Beneficiation	20	9
CHMT7059A	Coal Conversion and Gasification	20	9
CHMT7060A	Coal and Carbon in the Metallurgical Industry	20	9
CHMT7068A	Underground Coal Gasification	20	9
CHMT7069A	Carbon Capture in Power Plants	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other Master's <i>courses</i> that are relevant to the field of study.			
c) Successfully complete a Research Methodology CHMT7077A <i>course</i> yielding a minimum of 10 <i>credits</i> at an NQF level 9 and a <i>Research Report</i> (CHMT7008A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field Petroleum, Oil and Gas Engineering.			

6.2) in the field of Extractive Metallurgy

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding 80 <i>credits</i> :			
CHMT7028A	Physical Processing of Ores	20	9
CHMT7029A	Mineral Beneficiation	20	9
CHMT7030A	Leaching Operations in Hydrometallurgy	20	9
CHMT7031A	Electrometallurgy	20	9
CHMT7032A	Separation Operations in Hydrometallurgy	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other masters <i>courses</i> that are relevant to the field of study.			
c) Successfully complete a Research Methodology CHMT7077A <i>course</i> yielding a minimum of 10 <i>credits</i> at an NQF level 9 and a <i>Research Report</i> (CHMT7008A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field Extractive Metallurgy.			

6.3) in the field of Pyrometallurgy

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding 80 <i>credits</i> :			
CHMT7013A	Solid, Liquid and Gaseous State Pyrometallurgical Processes	20	9
CHMT7016A	Selected /Special Topics in Pyrometallurgy	20	9
CHMT7011A	Physicochemical Principles of Refractory Use	20	9

Course Code	Course Description	NQF Credits	NQF Level
CHMT7012A	Principles of Modelling and Control of Pyrometallurgical Processes	20	9
CHMT7014A	Kinetics and Transport Phenomena in Pyrometallurgy	20	9
CHMT7015A	Thermodynamics and Phase Equilibria in Pyrometallurgy	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other masters <i>courses</i> that are relevant to the field of study.			
c) Successfully complete a Research Methodology CHMT7077A course yielding a minimum of 10 <i>credits</i> at an NQF level 9 and a <i>Research Report</i> (CHMT7008A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field Petroleum, Oil and Gas Engineering.			

6.4) in the field of **Materials Science and Engineering**

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding 80 <i>credits</i> :			
CHMT7018A	Materials Characterisation	20	9
CHMT7019A	Advanced Materials Processing	20	9
CHMT7020A	Principles of Ceramic Processing	20	9
CHMT7022A	Failure Analysis of Engineering Materials	20	9
CHMT7024A	Structure and Properties of Engineering Materials	20	9
CHMT7025A	Electrical, Magnetic, Optical and Thermal Properties of Materials	20	9
CHMT7027A	Thermodynamics & Phase Equilibria of Materials	20	9
CHMT7067A	Tribology: Friction, Wear and Lubrication	20	9
CHMT7071A	Tribology of Materials	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other masters <i>courses</i> that are relevant to the field of study.			
c) Successfully complete a Research Methodology CHMT7077A <i>course</i> yielding a minimum of 10 <i>credits</i> at an NQF level 9 and a <i>Research Report</i> (CHMT7008A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field Petroleum, Oil and Gas Engineering.			

6.5) in the field of **Welding Engineering**

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding 80 <i>credits</i> :			
CHMT7043A	Welding Processes and Equipment	20	9
CHMT7045A	Advanced Welding Processes	20	9
CHMT7049A	Welding Metallurgy of Steels	20	9
CHMT7050A	Weldability of Alloy Steels and Stainless Steels	20	9
CHMT7051A	Weldability of Ferrous and Non-Ferrous Materials	20	9
CHMT7073A	Design and construction of welded structures under static loading	20	9

Course Code	Course Description	NQF Credits	NQF Level
CHMT7074A	Design and construction of welded structures under dynamic loading	20	9
b) Should a <i>student</i> wish to complete a Research Methodology CHMT7077A course yielding a minimum of 10 <i>credits</i> at an NQF level 9 they may do so, but this is deemed to be an optional course.			
d) Successfully complete a <i>Research Report</i> (CHMT7008A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field Welding Engineering.			

7) Branch of Mining Engineering

Programme Code: ECA00	NQF Exit Level: 9
Plan Code: EFAMIN60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below as may be offered in an academic year, totaling 80 <i>credits</i> :			
MINN7000A	Principles of Ventilation	20	9
MINN7001A	Environmental Engineering Topics	20	9
MINN7005A	Mechanical Properties of Rocks and Rock Masses	20	9
MINN7006A	Geostatistical Methods in Mineral Evaluation	20	9
MINN7007A	Statistical Valuation of Ore Reserves	20	9
MINN7008A	Numerical Modelling Techniques in Rock Engineering	20	9
MINN7009A	Trackless Mechanised Mining	20	9
MINN7010A	Advanced Mechanics of Solids	20	9
MINN7012A	Study and Control of Mining Induced Seismicity	20	9
MINN7013A	Surface Subsidence due to Underground Mining	20	9
MINN7014A	Mineral Economics	20	9
MINN7015A	Mineral Policy and Investment	20	9
MINN7016A	Beneficiation Economics	20	9
MINN7017A	Environmental Economics	20	9
MINN7018A	Design of Support Systems for Underground Mine Workings	20	9
MINN7022A	Mechanics and Design of Major Rock Slopes	20	9
MINN7023A	Coal - its Quality and Utilisation	20	9
MINN7024A	Geographical Information Systems	20	9
MINN7025A	Mining and the Environment	20	9
MINN7026A	Economic Geology of Mafic/Ultramafic Igneous Rocks	20	9
MINN7027A	Geology of Base Metal Deposits	20	9
MINN7028A	Economic Geology of the South African Coal	20	9
MINN7029A	Applied Geophysics in Mining Exploration	20	9
MINN7030A	Economic Geology of Lode Gold Deposits	20	9

Course Code	Course Description	NQF Credits	NQF Level
MINN7031A	Economic Geology on Witwatersrand Mines	20	9
MINN7033A	Practical Application of Simulation Techniques	20	9
MINN7034A	Mine Design – Underground Coal Mining	20	9
MINN7036A	Rock Mass Classification in Rock Engineering	20	9
MINN7037A	Blasting Technology	20	9
MINN7038A	Minerals Marketing	20	9
MINN7039A	Economics of Energy Resources	20	9
MINN7041A	Decision-making for Mining Investments	20	9
MINN7043A	Practical Implementation of Geostatistical Ore Evaluation Techniques	20	9
MINN7046A	Atmospheric Environmental Control and Mining	20	9
MINN7047A	Coal Extraction and Exploitation	20	9
MINN7048A	Coal and the Environment	20	9
MINN7049A	Risk Management in Mining	20	9
MINN7050A	Mineral Resource Management	20	9
MINN7052A	Compliance and Reporting Rules in the Minerals Industry	20	9
MINN7053A	Economic Definition of Ore	20	9
MINN7054A	Theoretical Simulation Techniques	20	9
MINN7055A	Advanced Mine Valuation	20	9
MINN7056A	Analytical Techniques and Quality Assurance	20	9
MINN7057A	Enterprise Risk Analysis in Mining Projects	20	9
MINN7058A	Evaluation of Risk as a Decision-making Criterion	20	9
MINN7061A	Sampling Theory and Methods	20	9
MINN7062A	Probability and Risk in Rock Engineering	20	9
MINN7063A	Grade Control Techniques and Applications	20	9
MINN7065A	Strategic Planning in Mining	20	9
MINN7066A	Open Pit Planning and Optimisation	20	9
MINN7067A	Option Pricing in Mining	20	9
MINN7068A	Enterprise and Financial Risk in Mining	20	9
MINN7069A	Strategy, Operations and Risk Management for Minerals Resources Companies	20	9
MINN7070A	Real Options in Mining Applications	20	9
MINN7071A	Planning a Block Cave	20	9
MINN7072A	Block Caving Principles	20	9
MINN7073A	Block Cave Construction and Production	20	9
MINN7074A	Slope Stability Monitoring	20	9
MINN7075A	Accident Investigations in Mining and Related Industries	20	9

Course Code	Course Description	NQF Credits	NQF Level
MINN7076A	Sustainable Development in Mining and Industry	20	9
MINN7078A	Safety & Health Leadership and Human Factors	20	9
MINN7079A	Safety; Health; Environment and Community Systems	20	9
MINN7080A	Earth Moving Equipment; Technology and Management	20	9
MINN7082A	Occupational Health and Hygiene for Non Specialists	20	9
MINN7083A	Rock Cutting Technology	20	9
MINN7084A	Socio-Economic Development in Mining Communities	20	9
MINN7085A	Valuation of Mineral Assets	20	9
MINN7086A	Valuation and Accounting Standards	20	9
MINN7087A	Approaches to Valuation in Extractive Industries	20	9
MINN7088A	Advanced Mineral Asset Valuation	20	9
MINN7089A	Mine Planning Principles	20	9
MINN7090A	Planning and Optimisation of Underground Mines	20	9
MINN7091A	Planning and Optimisation of Surface Mines	20	9
MINN7092A	Mine Financial Valuation	20	9
MINN7093A	Applied Operations in Research in Mineral Resource Management	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other Master's <i>courses</i> that are relevant to the field of study.			
c) A candidate must complete the Research Methodology course before being permitted to register for the Reserach Report.			

3.3.3.8 Master of Science in Aeronautical Engineering

For the Master of Science in Aeronautical Engineering a *candidate* shall complete a *programme* approved by the *Senate* of advanced coursework and a *Research Report*. An approved *curriculum* will comprise the-Embry-Riddle Aeronautical University Coursework in Aeronautical Engineering course (MECN7116A) at NQF level 9, a Research Methods in Engineering course (MECN7066A) yielding a minimum of 10 *credits* at NQF level 9 and a *Research Report* (MECN7018A) yielding 90 *credits* at NQF level 9 on a topic appropriate the field of study or in a field within such a branch as determined by the *Senate* from time to time.

A *candidate* may be required in terms of Rule G4.11.4 to register for undergraduate *courses*, for which no credit shall be obtained.

The *Research Report* must be conducted under the direction of a supervisor approved by the *Senate*, and must, in the opinion of the *Senate*, require not less than the equivalent of six months of full-time work.

Programme Code: ECA02		NQF Exit Level: 9	
Plan Code: EPAAERO60		Total NQF Credits: 180	
Course Code	Course Description	NQF Credits	NQF Level
a) The following <i>courses</i> is prescribed:			
*MECN7116A	Embry-Riddle Aeronautical University Coursework in Aeronautical Engineering	80	9

Course Code	Course Description	NQF Credits	NQF Level
b) Successfully complete a Research Methods in Engineering course (MECN7066A) yielding a minimum of 10 credits at an NQF level 9 and a Research Report (MECN7018A) yielding 90 credits at an NQF level 9 on a topic appropriate to the field of Aerospace engineering.			
*Note: Credit is granted for MECN7116A after successful completion of all coursework components with Embry-Riddle Aeronautical University. This coursework is delivered on an online format.			

3.3.3.9 Master of Science in Bulk Solids Handling

For the Master of Science in Bulk Materials Handling a candidate shall complete a programme approved by the Senate of advanced coursework and a Research Report.

An approved curriculum will comprise a programme of four courses yielding 20 credits each at NQF level 9, a Research Methodology course (MECN7066A) yielding a minimum of 10 credits at NQF level 9 and a Research Report (MECN7018A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study or in a field within such a branch as determined by the Senate from time to time.

A candidate may be required in terms of Rule G4.11.4 to register for undergraduate courses, for which no credit shall be obtained.

The Research Report must be conducted under the direction of a supervisor approved by the Senate, and must, in the opinion of the Senate, require not less than the equivalent of six months of full-time work.

Programme Code: ECA03	NQF Exit Level: 9
Plan Code: EPABMH60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
a) The following courses are prescribed:			
MECN7034A	Bulk Solids Storage and Handling	20	9
MECN7035A	Belt Conveying of Bulk Solids	20	9
MECN7071A	Pipeline Conveying of Bulk Materials	20	9
Note: If one of the compulsory courses is not offered during the period of registration then it may be substituted by an additional elective course as specified below.			
b) One elective course selected from courses at a Master's level from Mechanical or Mining Engineering, as may be offered in any year, yielding 20 credits.			
c) Successfully complete a Research Methods in Engineering course (MECN7066A) yielding a minimum of 10 credits at an NQF level 9 and a Research Report (MECN7018A) yielding 90 credits at an NQF level 9 on a topic appropriate to the field of Bulk Solids Handling.			

3.3.3.10 Master of Science in Engineering Management

For the Master of Science in Engineering Management a candidate shall complete a programme approved by the Senate of advanced coursework and a Research Report.

An approved curriculum will comprise a programme of four courses yielding 20 credit each at NQF level 9, a Research Methodology course (MECN7066A) yielding a minimum of 10 credits at NQF level 9 and a Research Report (MECN7018A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study or in a field within such a branch as determined by the from time to time.

A candidate may be required in terms of Rule G4.11.4 to register for undergraduate courses, for which no credit shall be obtained.

The *Research Report* must be conducted under the direction of a supervisor approved by the *Senate*, and must, in the opinion of the *Senate*, require not less than the equivalent of six months of full-time work.

Programme Code: ECA04	NQF Exit Level: 9
Plan Code: EPAEMAN60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
a) <i>Courses</i> selected from the list of elective <i>courses</i> below yielding a minimum of 60 <i>credits</i> as may be offered in any year:			
MECN7005A	Engineering Economics	20	9
MECN7007A	Elements of Commercial and Industrial Law	20	9
MECN7008A	Financial Management (pre-requisite MECN 7011A)	20	9
MECN7009A	Principles of Management	20	9
MECN7010A	Human Resource Management	20	9
MECN7011A	Accounting and Financial Statements	20	9
MECN7029A	Mathematical Topics for Engineering Management	20	9
MECN7032A	Management Accounting	20	9
MECN7051A	Business to Business Marketing	20	9
MECN7113A	Strategic Management in Engineering	20	9
b) One elective <i>course</i> selected from <i>courses</i> at a Master's level from Industrial Engineering, as may be offered in any year, yielding 20 <i>credits</i> .			
c) Successfully complete a Research Methods in Engineering <i>course</i> (MECN7066A) yielding a minimum of 10 <i>credits</i> at an NQF level 9 and a <i>Research Report</i> (MECN7018A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of Engineering Management.			

3.3.3.11 Master of Science in Mechanical Engineering

Programme Code: ECA05	NQF Exit Level: 9
Plan Code: EPAMECN60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
a) <i>Courses</i> selected from the list of elective <i>courses</i> below yielding a minimum of 60 <i>credits</i> as may be offered in any year:			
MECN7001A	Reliability Engineering	20	9
MECN7013A	Principles of Air Conditioning	20	9
MECN7014A	Principles of Refrigeration	20	9
MECN7019A	Internal Combustion Engine Analysis	20	9
MECN7021A	Analysis of Composite Structures	20	9
MECN7024A	Maintenance Engineering	20	9
MECN7026A	Finite Element Methods	20	9
MECN7033A	Automotive Engineering	20	9

Course Code	Course Description	NQF Credits	NQF Level
MECN7034A	Bulk Solids Storage and Handling	20	9
MECN7035A	Belt Conveying of Bulk Solids	20	9
MECN7061A	Extended Finite Element Methods and Meshfree Methods	20	9
MECN7118A	Machine Learning for Engineers	20	9
b) One elective <i>course</i> selected from <i>courses</i> at a Masters level from Industrial Engineering, Systems Engineering or the Branch of Aeronautical Engineering, as may be offered in any year, yielding 20 <i>credits</i> .			
c) Successfully complete a Research Methods in Engineering <i>course</i> (MECN7066A) yielding a minimum of 10 <i>credits</i> at an NQF level 9 and a <i>Research Report</i> (MECN7018A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of Mechanical Engineering.			

3.3.3.12 Master of Science in Industrial Engineering

For the Master of Science in Industrial Engineering a *candidate* shall complete a *programme* approved by the *Senate* of advanced coursework and a *Research Report*.

An approved *curriculum* will comprise a *programme* of four 20 *credit courses* at an NQF level 9, a Research Methodology *course* (MECN7066A) yielding a minimum of 10*credits* at an NQF level 9 and a *Research Report* (MECN7018A) yielding 90 *credits* at an NQF level 9 on a topic appropriate to Industrial Engineering or in a field within such a branch as determined by the *Senate* from time to time.

A *candidate* may be required in terms of Rule G4.11.4 to register for undergraduate *courses*, for which no *credit* shall be obtained.

The *Research Report* must be conducted under the direction of a supervisor approved by the *Senate*, and must, in the opinion of the *Senate*, require not less than the equivalent of six months of full-time work.

Programme Code: ECA06		NQF Exit Level: 9	
Plan Code: EPAINDE60		Total NQF Credits: 180	
Course Code	Course Description	NQF Credits	NQF Level
a) <i>Courses</i> selected from the list of elective <i>courses</i> below yielding a minimum of 60 <i>credits</i> as may be offered in any year:			
MECN7000A	Operational Research Methods	20	9
MECN7006A	Production and Operations Management	20	9
MECN7060A	Operations Management for Mining Systems	20	9
MECN7016A	Quality Management	20	9
MECN7017A	Value Engineering and Analysis	20	9
MECN7023A	Management of Technology	20	9
MECN7027A	Discrete Event Simulation	20	9
MECN7118A	Lean Operations	20	9
MECN7029A	Mathematical Topics for Engineering Management	20	9
MECN7054A	Systems Engineering: Soft Systems Methodologies	20	9

Course Code	Course Description	NQF Credits	NQF Level
MECN7062A	Systems Engineering: An Overview	20	9
MECN7057A	Enterprise Engineering	20	9
MECN7059A	Supply Chain Management	20	9
MECN7065A	Service Engineering	20	9
MECN7114A	Operations Strategy	20	9
MECN7118A	Machine Learning for Engineers	20	9
b) One elective <i>course</i> selected from <i>courses</i> at a Masters level from Engineering Management or Mechanical Engineering, as may be offered in any year, yielding 20 <i>credits</i> .			
c) Successfully complete a Research Methods in Engineering <i>course</i> (MECN7066A) yielding a minimum of 10 <i>credits</i> at an NQF level 9 and a <i>Research Report</i> (MECN7018A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of Industrial Engineering.			

3.3.3.13 Master of Science in Systems Engineering

For the Master of Science in Systems Engineering a *candidate* shall complete a *programme* approved by the *Senate* of advanced coursework and a *Research Report*. An approved *curriculum* will comprise a *programme* of four 20 *credit courses* at an NQF level 9, a Research Methodology *course* (MECN7066A) yielding a minimum of 10 *credits* at an NQF level 9 and a *Research Report* (MECN7018A) yielding 90 *credits* at an NQF level 9 on a topic appropriate to Systems Engineering or in a field within such a branch as determined by the *Senate* from time to time.

A *candidate* may be required in terms of Rule G4.11.4 to register for undergraduate *courses*, for which no credit shall be obtained.

The *Research Report* must be conducted under the direction of a supervisor approved by the *Senate*, and must, in the opinion of the *Senate*, require not less than the equivalent of six months of full-time work.

Programme Code: ECA07		NQF Exit Level: 9	
Plan Code: EPASYSE60		Total NQF Credits: 180	
Course Code	Course Description	NQF Credits	NQF Level
a) The following <i>courses</i> are prescribed:			
MECN7055A	Requirements Analysis in Systems Engineering	20	9
MECN7056A	Systems Engineering: Architecture	20	9
MECN7058A	Systems Engineering: Hard Systems	20	9
b) <i>Courses</i> selected from the list of elective <i>courses</i> below yielding 20 <i>credits</i> as may be offered in any year:			
MECN7000A	Operations Research	20	9
MECN7053A	Systems Engineering Management	20	9
MECN7054A	Systems Engineering: Soft Systems Methodologies	20	9
c) Successfully complete a Research Methods in Engineering <i>course</i> (MECN7066A) yielding a minimum of 10 <i>credits</i> at an NQF level 9 and a <i>Research Report</i> (MECN7018A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of Systems Engineering.			

3.3.3.14 Master of Engineering (Professional)

1) Curricula

A candidate for the Master of Engineering (Professional) must complete a *programme* yielding 180 *credits*, comprising of coursework and a Research/Industrial Project in a field approved by the *Senate*.

An approved *curriculum* will comprise of –

- a) six *courses*, yielding 20 *credits* each and a Research Methods in Engineering/Research Methodology course yielding a minimum of 15 *credits* (yielding a total of 135 coursework *credits*) and a Research/Industrial Project *course* yielding 45 *credits*; or
- b) in the Branch of Civil Engineering seven *courses*, yielding 20 *credits* each and a Research/Industrial Project *course* yielding 45 *credits*, making a total of 185 *credits*. The *Research Report* must be conducted under the direction of a supervisor approved by the *Senate*, aimed at developing professional competencies.; or
- c) in the Branch of Aeronautical Engineering one course yielding 80 credits, two courses yielding 20 credits each and a Research Methods in Engineering/Research Methodology course yielding a minimum of 15 credits, yielding 135 coursework credits and a Research/Industrial Project course yielding 45 credits.

2) Branches

The Master of Engineering (Professional) is offered in the following branches or fields within a branch:

2.1) Branch of Aeronautical Engineering

Programme Code: ECA01	NQF Exit Level: 9
Plan Code: EFAAERO60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
a) The following <i>course</i> is prescribed			
*MECN7116A	Embry-Riddle Aeronautical University Coursework in Aeronautical Engineering	80	9
b) At least two <i>courses</i> selected from the list of elective <i>courses</i> below as may be offered in any year:			
MECN7001A	Reliability Engineering	20	9
MECN7006A	Production and Operations Management	20	9
MECN7017A	Value Engineering and Analysis	20	9
MECN7023A	Management of Technology	20	9
MECN7024A	Maintenance Engineering	20	9
MECN7026A	Finite Element Methods	20	9
MECN7054A	Systems Engineering: Hard Systems Methodologies	20	9
MECN7058A	Systems Engineering: Soft Systems Methodologies	20	9
MECN7059A	Supply Chain Management	20	9
MECN7062A	Systems Engineering: An Overview	20	9
MECN7065A	Service Engineering	20	9
MECN7114A	Operations Strategy	20	9
MECN7117A	Lean Operations	20	9

Course Code	Course Description	NQF Credits	NQF Level
MECN7118A	Machine Learning for Engineers	20	9
c) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace the <i>courses</i> in (b) with <i>courses</i> from the fields of Industrial Engineering, Engineering Management and Systems Engineering, or the Branch of Mechanical Engineering.			
d) Successfully complete an Engineering Investigational Methods (MECN7112A) <i>course</i> yielding a minimum of 15 <i>credits</i> at an <i>NQF</i> level 9 and a Research/Industrial Project (MECN7111A) yielding 45 <i>credits</i> at an <i>NQF</i> level 9 on a topic appropriate to the field of Aerospace engineering.			
*Note: Credit is granted for MECN7116A after successful completion of all coursework components with Embry-Riddle Aeronautical University. This coursework is delivered on an online format.			

2.2) Branch of Civil Engineering

Programme Code: ECA01	NQF Exit Level: 9
Plan Code: EFACIVN60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of <i>courses</i> listed below yielding 140 <i>credits</i> :			
CIVN7000A	Non-Linear Analysis of Structures	20	9
CIVN7005A	Dynamic loading and structural dynamics	20	9
CIVN7006A	Employment Creation in Road Construction and Maintenance	20	9
CIVN7007A	Employment creation in the construction and Maintenance of Infrastructure	20	9
CIVN7012A	Advanced Design of Structural Steel	20	9
CIVN7013A	Wastewater Engineering	20	9
CIVN7016A	Hydraulic Structures	20	9
CIVN7018A	Project Management in Construction	20	9
CIVN7020A	Project Management in Developing Areas	20	9
CIVN7021A	Advanced Geotechnical Site Investigation	20	9
CIVN7022A	Advanced Geotechnical Site Investigation	20	9
CIVN7023A	Deep Foundations and Anchors	20	9
CIVN7024A	Environmental Management	20	9
CIVN7025A	Construction Site Management	20	9
CIVN7026A	Analysis and Design of Shell Structures	20	9
CIVN7027A	Theoretical Soil Mechanics	20	9
CIVN7028A	Earth Pressures & Retaining Structures	20	9
CIVN7029A	Urban Engineering Context	20	9
CIVN7030A	Science and Technology Policy for Development	20	9
CIVN7033A	Water Quality Modelling	20	9

Course Code	Course Description	NQF Credits	NQF Level
CIVN7035A	River Hydraulics	20	9
CIVN7036A	Finite Element Analysis of Structures	20	9
CIVN7038A	Project Management I	20	9
CIVN7039A	Project Management II	20	9
CIVN7042A	Select Topics - Civil Engineering	20	9
CIVN7044A	Pollution Control and Abatement	20	9
CIVN7045A	GIS Applications in Environmental Planning, Management and Decision-Making	20	9
CIVN7046A	Advanced Prestressed Concrete Design	20	9
CIVN7047A	Advanced Reinforced Concrete Design	20	9
CIVN7051A	Introduction to Industrial Ecology	20	9
CIVN7053A	Design for the Environment	20	9
CIVN7054A	Air Resources Engineering	20	9
CIVN7058A	Rural Water Supply and Sanitation	20	9
CIVN7059A	Water Management	20	9
CIVN7060A	Hydraulic Modelling	20	9
CIVN7061A	Water Supply and Urban Drainage	20	9
CIVN7062A	Design of Masonry Structures	20	9
CIVN7063A	Chemistry, Durability and Performance of Concrete in Structures	20	9
CIVN7064A	Advanced Concrete Technology	20	9
CIVN7065A	Water Resources Planning	20	9
CIVN7066A	Durability, Assessment and Repair of Concrete Structures	20	9
CIVN7068A	Environmental Engineering Design	20	9
CIVN7069A	Managing the Environmental Impact of Nuclear Project Lifecycle	20	9
CIVN7071A	Critical State Soil Mechanics	20	9
CIVN7072A	Analytic Methods in Geomechanics	20	9
CIVN7074A	Management of Tailings Storage Facilities	20	9
CIVN7075A	Sustainability for the Built Environment	20	9
CIVN7073A	Transport Modelling Analysis	20	9
b) Successfully complete a Research/Industrial Project (CIVN7070A) yielding 45 credits at an NQF level 9 on a topic appropriate to the field of Civil Engineering.			
c) Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other masters courses that are relevant to the field of study.			

2.3) Branch of Electrical Engineering

Programme Code: ECA01	NQF Exit Level: 9
Plan Code: EFAELEN60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of the <i>courses</i> listed below yielding 120 <i>credits</i> :			
ELEN7059A	Principles of Communications Systems	20	9
ELEN7015A	Teletraffic Engineering	20	9
ELEN7064A	Principles of Wireless Communication/LTE	20	9
ELEN7062A	Coding Techniques and Telecommunications	20	9
ELEN7011A	Selected Topics in Telecommunications	20	9
ELEN7044A	Introduction to Software Engineering	20	9
ELEN7055A	Database Systems	20	9
ELEN7045A	Software Development Methodologies, Analysis & Design	20	9
ELEN7046A	Software Technologies and Techniques	20	9
ELEN7047A	Software Project Management	20	9
ELEN7012A	Selected Topics in Software Engineering	20	9
ELEN7009A	Principles of Insulation Coordination in Electrical Power Systems	20	9
ELEN7018A	Earthing and Lightning Protection	20	9
ELEN7043A	Advanced Electromechanical Conversion	20	9
ELEN7048A	Variable Speed Drives for AC Machines	20	9
ELEN7056A	Power Electronics	20	9
ELEN7013A	Selected Topics in Power Engineering	20	9
ELEN7069A	Applied Quantum Computing	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one or more of the above <i>courses</i> with one or more other masters <i>courses</i> that are relevant to the field of study.			
c) Successfully complete a Research Methods in Engineering/Research Methodology <i>course</i> yielding a minimum of 15 <i>credits</i> at an NQF level 9 and a Research/Industrial Project (ELEN7068A) yielding 45 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of Electrical Engineering.			

2.4) Branch of Industrial Engineering**2.4.1) In the field of Engineering Management**

Programme Code: ECA01	NQF Exit Level: 9
Plan Code: EFAIND61	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of the <i>courses</i> listed below yielding 120 <i>credits</i> :			
MECN7005A	Engineering Economics	20	9

Course Code	Course Description	NQF Credits	NQF Level
MECN7007A	Elements of Commercial and Industrial Law	20	9
MECN7008A	Financial Management (pre-requisite MECN 7011A)	20	9
MECN7009A	Principles of Management	20	9
MECN7010A	Human Resource Management	20	9
MECN7011A	Accounting and Financial Statements	20	9
MECN7029A	Mathematical Topics for Engineering Management	20	9
MECN7032A	Management Accounting	20	9
MECN7051A	Business to Business Marketing	20	9
MECN7113A	Strategic Management in Engineering	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one of the <i>courses</i> in a) above with one other masters <i>course</i> from the field of Industrial Engineering.			
c) Successfully complete an Engineering Investigational Methods (MECN7112A) <i>course</i> yielding a minimum of 15 <i>credits</i> at an NQF level 9 and a Research/Industrial Project (MECN7111A) yielding 45 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of Engineering Management.			

2.4.2) In the field of Industrial Engineering

Programme Code: ECA01	NQF Exit Level: 9
Plan Code: EFAIND61	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of the <i>courses</i> listed below yielding 120 <i>credits</i> :			
MECN7000A	Operational Research Methods	20	9
MECN7006A	Production and Operations Management or	20	9
MECN7060A	Operations Management for Mining Systems	20	9
MECN7016A	Quality Management	20	9
MECN7017A	Value Engineering and Analysis	20	9
MECN7023A	Management of Technology	20	9
MECN7027A	Discrete Event Simulation	20	9
MECN7117A	Lean Operations	20	9
MECN7029A	Mathematical Topics for Engineering Management	20	9
MECN7054A	Systems Engineering: Soft Systems Methodologies	20	9
MECN7062A	Systems Engineering: An Overview	20	9
MECN7057A	Enterprise Engineering	20	9
MECN7059A	Supply Chain Management	20	9
MECN7065A	Service Engineering	20	9
MECN7108A	Lean Management of Health Care Systems	20	9

Course Code	Course Description	NQF Credits	NQF Level
MECN7113A	Strategic Management in Engineering	20	9
MECN7114A	Operations Strategy	20	9
MECN7118A	Machine Learning for Engineers	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one of the <i>courses</i> in a) above with one other masters course from the field of Engineering Management, Systems Engineering or in the Branch of Mechanical Engineering.			
c) Successfully complete an Engineering Investigational Methods (MECN7112A) <i>course</i> yielding a minimum of 15 <i>credits</i> at an <i>NQF</i> level 9 and a Research/Industrial Project (MECN7111A) yielding 45 <i>credits</i> at an <i>NQF</i> level 9 on a topic appropriate to the field of Industrial Engineering.			

2.4.3) In the field of Systems Engineering

Programme Code: ECA01		NQF Exit Level: 9	
Plan Code: EFAIND61		Total NQF Credits: 180	
Course Code	Course Description	NQF Credits	NQF Level
a) The following <i>courses</i> are prescribed:			
MECN7055A	Requirements Analysis in Systems Engineering Systems	20	9
MECN7056A	Systems Engineering: Architecture	20	9
MECN7058A	Systems Engineering: Hard Systems	20	9
b) A combination of <i>courses</i> listed below yielding 60 <i>credits</i> , as may be offered in any year:			
MECN7000A	Operations Research	20	9
MECN7053A	Systems Engineering Management	20	9
MECN7054A	Systems Engineering: Soft Systems Methodologies	20	9
MECN7113A	Strategic Management in Engineering	20	9
c) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace one of the <i>courses</i> in b) above with one other masters <i>course</i> from the field of Industrial Engineering, Engineering Management or the Branch of Mechanical or Aeronautical Engineering.			
d) Successfully complete an Engineering Investigational Methods (MECN7112A) <i>course</i> yielding a minimum of 15 <i>credits</i> at an <i>NQF</i> level 9 and a Research/Industrial Project (MECN7111A) yielding 45 <i>credits</i> at an <i>NQF</i> level 9 on a topic appropriate to the field of Systems Engineering.			

2.5) Branch of Mechanical Engineering

Programme Code: ECA01		NQF Exit Level: 9	
Plan Code: EFAMECN60		Total NQF Credits: 180	
Course Code	Course Description	NQF Credits	NQF Level
a) A combination of the <i>courses</i> listed below yielding 120 <i>credits</i> :			
MECN7001A	Reliability Engineering	20	9
MECN7013A	Principles of Air Conditioning	20	9

Course Code	Course Description	NQF Credits	NQF Level
MECN7014A	Principles of Refrigeration	20	9
MECN7019A	Internal Combustion Engine Analysis	20	9
MECN7021A	Analysis of Composite Structures	20	9
MECN7024A	Maintenance Engineering	20	9
MECN7026A	Finite Element Methods	20	9
MECN7033A	Automotive Engineering	20	9
MECN7034A	Bulk Solids Storage and Handling	20	9
MECN7035A	Belt Conveying of Bulk Solids	20	9
MECN7061A	Extended Finite Element Methods and Meshfree Methods	20	9
MECN7109A	The Mechanics of Heavy Vehicles	20	9
MECN7110A	Vehicle Dynamics and Automotive Engineering	20	9
MECN7118A	Machine Learning for Engineers	20	9

b) Provided that the *Senate* may permit a candidate to replace one of the *courses* in a) above with one other masters *course* from the field of Industrial Engineering, Engineering Management and Systems Engineering or the Branch of Aeronautical Engineering.

c) Successfully complete an Engineering Investigational Methods (MECN7112A) *course* yielding a minimum of 15 *credits* at an NQF level 9 and a Research/Industrial Project (MECN7111A) yielding 45 *credits* at an NQF level 9 on a topic appropriate to the field of Mechanical Engineering.

2.6) Branch of Mechanical, Industrial and Aeronautical Engineering

Programme Code: ECA01	NQF Exit Level: 9
Plan Code: EFAMIA60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
a) A combination of the <i>courses</i> listed below yielding 120 <i>credits</i> :			
MECN7005A	Engineering Economics	20	9
MECN7029A	Mathematical Topics for Engineering Management	20	9
MECN7006A	Production and Ops Management	20	9
MECN7017A	Value Engineering and Analysis	20	9
MECN7023A	Management of Technology	20	9
MECN7028A	Lean Operations	20	9
MECN7057A	Enterprise Engineering	20	9
MECN7059A	Supply Chain Management	20	9
MECN7065A	Service Engineering	20	9
MECN7001A	Reliability Engineering	20	9
MECN7024A	Maintenance Engineering	20	9
MECN7026A	Finite Element Methods	20	9
MECN7034A	Bulk Solids Storage and Handling	20	9

Course Code	Course Description	NQF Credits	NQF Level
MECN7035A	Belt Conveying of Bulk Solids	20	9
MECN7054A	Systems Engineering: Hard Systems Methodologies	20	9
MECN7058A	Systems Engineering: Soft Systems Methodologies	20	9
MECN7114A	Operations Strategy	20	9
MECN7118A	Machine Learning for Engineers	20	9
b) Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace the above <i>courses</i> with <i>courses</i> from Branches/fields within the Faculty of Engineering and the Built Environment yielding a maximum of 40 <i>credits</i> .			
c) Successfully complete an Engineering Investigational Methods (MECN7112A) <i>course</i> yielding a minimum of 15 <i>credits</i> at an NQF level 9 and a Research/Industrial Project (MECN7111A) yielding 45 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of Mechanical, Industrial or Aeronautical Engineering.			

2.7) Branch of Metallurgy and Materials Engineering

2.7.1) In the field of Welding Metallurgy

Programme Code: ECA01		NQF Exit Level: 9	
Plan Code: EFACHMT60		Total NQF Credits: 180	
Course Code	Course Description	NQF Credits	NQF Level
a) A combination of the <i>courses</i> listed below yielding 120 <i>credits</i> :			
CHMT7045A	Advanced Welding Processes	20	9
CHMT7046A	Fabrication applications engineering	20	9
CHMT7047A	Non-destructive testing methods and economics	20	9
CHMT7052A	Case Studies for Welding Engineers	20	9
CHMT7053A	Practical Education welding and fabrication processes	20	9
CHMT7073A	Design and Construction of Welded Structures under Static Loading	20	9
CHMT7074A	Design and construction of Welded Structures under Dynamic Loading	20	9
b) Successfully complete a Research Methodology CHMT7078A <i>course</i> yielding a minimum of 15 <i>credits</i> at an NQF level 9 and a Research/Industrial Project (CHMT7075A) yielding 45 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of Welding Metallurgy.			

3.3.3.15 Master of Urban Design

Programme Code: FCA13		NQF Exit Level: 9	
Plan Code: FPAMUD61		Total NQF Credits: 180	
Course Code	Course Description	NQF Credits	NQF Level
A <i>candidate</i> must complete the four <i>core courses</i> and three <i>elective courses</i> .			
a) <i>Core Courses</i>			
ARPL7010A	Understanding Cities of the South	20	9

Course Code	Course Description	NQF Credits	NQF Level
ARPL7011A	Urban Design Theory and History	20	9
ARPL7040A	Research Methods	10	9
ARPL7057A	Urban Design Professional Practice	10	9
b) Elective Courses			
ARPL7058A	Global City Studio	10	9
ARPL7059A	Accessible City Studio	10	9
ARPL7060A	Sustainable City Studio	10	9
ARPL7061A	Transforming City Studio	10	9
Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other courses that are relevant to the field of urban design.			
c) A candidate must also pass a Research Report (ARPL7062A) yielding 90 credits at an NQF level 9 on a topic appropriate to the field of urban design and approved by the Senate.			
A candidate who, in the opinion of the Senate, lacks the necessary GIS and graphic skills, may be required to complete part of or all of the course:			
ARPL7052A Technologies and Techniques for the Built Environment			

3.3.3.16 Master of Urban Studies

1) In the field of Housing and Human Settlements

Programme Code: FCA16	NQF Exit Level: 9
Plan Code: FFAHHS60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
A candidate must complete four core courses and one elective course:			
a) Core Courses			
ARPL7004A	Housing Theory Concepts and Policy	20	9
ARPL7005A	Social and Technical Sustainability in Housing	20	9
ARPL7040A	Research Methods	10	9
ARPL7066A	Housing Finance and Law	20	9
Provided that the Senate may permit a candidate to replace a maximum of two of the above course(s) with other approved course(s) at the level of master at this or another tertiary education institution approved by the Senate.			
b) Elective Courses			
ARPL7006A	Advanced Housing Finance	20	9
ARPL7007A	Housing Seminar	20	9
ARPL7067A	Management of Existing Housing Stock	20	9
ARPL7068A	Housing Construction Technology and Management	20	9
Provided that the Senate may permit a candidate to replace the elective course with other approved courses at the level of master at this or another tertiary education institution approved by the Senate, yielding an equivalent minimum of 20 credits.			

Course Code	Course Description	NQF Credits	NQF Level
c) A candidate must also pass a <i>Research Report</i> (ARPL7053A) yielding 90 credits at an NQF level 9 on a topic appropriate to the field of urban studies and approved by the Senate.			
A candidate who, in the opinion of the Senate, lacks the necessary GIS and graphic skills, may be required to complete part of or all of the course:			
ARPL7052A Technologies and Techniques for the Built Environment.			

2) In the field of Sustainable Energy Efficient Cities

Programme Code: FCA16	NQF Exit Level: 9
Plan Code: FFASEEC60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
A candidate must complete four core courses and one elective course:			
a) Core Courses			
ARPL7010A	Understanding cities of the South	20	9
ARPL7040A	Research Methods	10	9
ARPL7054A	Energy for sustainable cities	20	9
ARPL7055A	Energy efficiency and renewable energy for Buildings	20	9
Provided that the Senate may permit a candidate to replace a maximum of two of the above course(s) with other approved course(s) at the level of master at this or another tertiary education institution approved by the Senate.			
b) Elective Courses			
ARPL7005A	Social and technical sustainability in housing	20	9
ARPL7015A	Sustainable city studio	20	9
ARPL7032A	Environmental planning and sustainable	20	9
Provided that the Senate may permit a candidate to replace the elective course with other approved courses at the level of master at this or another tertiary education institution approved by the Senate, yielding an equivalent minimum of 20 credits.			
c) A candidate must also pass a <i>Research Report</i> (ARPL7053A) yielding 90 credits at an NQF level 9 on a topic appropriate to the field of urban studies and approved by the Senate.			
A candidate who, in the opinion of the Senate, lacks the necessary GIS and graphic skills, may be required to complete part of or all of the course:			
ARPL7052A Technologies and Techniques for the Built Environment.			

3) In the field of Urban Management

Programme Code: FCA16	NQF Exit Level: 9
Plan Code: FFAURM60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
A candidate must complete four core courses and one elective course:			
a) Core Courses			
ARPL7010A	Understanding Cities of the South	20	9

Course Code	Course Description	NQF Credits	NQF Level
ARPL7040A	Research Methods	10	9
ARPL7063A	Governance and Municipal Planning	20	9
ARPL7071A	Theory and Practice of Urban Management	20	9
Provided that the <i>Senate</i> may permit a candidate to replace a maximum of two of the above <i>course(s)</i> with other approved <i>course(s)</i> at the level of master at this or another tertiary education institution approved by the <i>Senate</i> .			
b) Elective Courses			
ARPL7032A	Environmental Planning and Sustainable	20	9
ARPL7044A	Community Participation in Urban Governance: Theories, Discourses and Practices	20	9
CIVN7020A	Project Management in Developing Areas	20	9
ARPL7067A	Management of Existing Housing Stock	20	9
Provided that the <i>Senate</i> may permit a <i>candidate</i> to replace the elective <i>course</i> with other approved <i>courses</i> at the level of master at this or another tertiary education institution approved by the <i>Senate</i> , yielding an equivalent minimum of 20 <i>credits</i> .			
c) A <i>candidate</i> must also pass a <i>Research Report</i> (ARPL7053A) yielding 90 <i>credits</i> at an NQF level 9 on a topic appropriate to the field of urban studies and approved by the <i>Senate</i> .			
A <i>candidate</i> who, in the opinion of the <i>Senate</i> , lacks the necessary GIS and graphic skills, may be required to complete part of or all of the <i>course</i> :			
ARPL7052A Technologies and Techniques for the Built Environment.			

4) In the field of Urban Politics and Governance

Programme Code: FCA16		NQF Exit Level: 9	
Plan Code: FFAURPG60		Total NQF Credits: 180	
Course Code	Course Description	NQF Credits	NQF Level
A <i>candidate</i> must complete four core <i>courses</i> and one elective <i>course</i> :			
a) Core Courses			
ARPL 7010A	Understanding Cities of the South	20	9
ARPL7040A	Research Methods	10	9
ARPL7044A	Community Participation in Urban Governance: Theories, Discourses and Practices	20	9
APRL 7048A	Democratic Theory	20	9
Provided that the <i>Senate</i> may permit a candidate to replace a maximum of two of the above <i>course(s)</i> with other approved <i>course(s)</i> at the level of master at this or another tertiary education institution approved by the <i>Senate</i> .			
b) Elective Courses			
ARPL7004A	Housing Theories, Concepts and Policies	20	9
ARPL7049A	Politics, Governance and the City	20	9

Course Code	Course Description	NQF Credits	NQF Level
ARPL7030A	Municipal Planning	20	9
ARPL7050A	The Making of Urban SA	20	9
ARPL7051A	State, Violence, Movements	20	9
ECON7046A	Political Economy of Development	25	
POLS7036A	The State in Africa: Democratisation and Crisis	30	9
Provided that the Senate may permit a candidate to replace the elective course with other approved courses at the level of master at this or another tertiary education institution approved by the Senate, yielding an equivalent minimum of 20 credits.			
c) A candidate must also pass a Research Report (ARPL7053A) yielding 90 credits at an NQF level 9 on a topic appropriate to the field of urban studies and approved by the Senate.			
A candidate who, in the opinion of the Senate, lacks the necessary GIS and graphic skills, may be required to complete part of or all of the course:			
ARPL7052A Technologies and Techniques for the Built Environment.			

5) *In the field of Urban Research*

Programme Code: FCA16	NQF Exit Level: 9
Plan Code: FFAURBR60	Total NQF Credits: 180

Course Code	Course Description	NQF Credits	NQF Level
A candidate must complete courses listed under a), b) and c) below:			
a) Core Courses: The following courses are prescribed:			
ARPL 7010A	Understanding Cities of the South	20	9
ARPL7034A	Specialised Topics in Planning	20	9
Provided that the Senate may permit a candidate to replace the above course(s) with other approved course(s) at the level of master, relevant to the field of urban studies and offered by the School of Architecture and Planning.			
b) Elective Courses: A candidate must select one of the two options listed below:			
i) SOSS7070A Advanced Statistics for Demographic Survey and Analysis		30	9
A candidate, who selects SOSS7070A, will be required to complete in addition, one elective course at the level of master, relevant to the field of urban studies and offered by the School of Architecture and Planning, yielding a minimum of 20 credits.			
ii) ARPL7040A Research Methods		10	9
A candidate who selects ARPL7040A will be required to complete in addition, two elective courses at the level of master, relevant to the field of urban studies at the level of master at this or another tertiary education institution approved by the Senate, yielding a minimum of 20 credits per course.			
Provided that the Senate may permit a candidate to replace an elective course with another approved course at the level of master at this or another tertiary education institution approved by the Senate, yielding a minimum of 20 credits.			

Course Code	Course Description	NQF Credits	NQF Level
c) A candidate must also pass a <i>Research Report</i> (ARPL7053A) yielding 90 credits at an NQF level 9 on a topic appropriate to the field of urban studies and approved by the Senate.			
A candidate who, in the opinion of the Senate, lacks the necessary GIS and graphic skills, may be required to complete part of or all of the course:			
ARPL7052A Technologies and Techniques for the Built Environment.			

3.3.4 Completion Rules

3.3.4.1 Conditions for award of degree

1) Master of Architecture (Professional)

- a) A candidate shall be required to pass every course at the first attempt, provided that the Senate may, in a case considered by it to be exceptional, permit a candidate who has failed a course to repeat it.
- b) A candidate who fails to obtain credit in Architectural Design and Discourse and who is permitted to repeat the course shall be required to select a new topic approved by the Senate.

2) Master of Science in Building

- a) A candidate for the Master of Science in Building (by coursework and *Research Report*) who fails any course(s) may repeat such course(s), or with special permission of the Senate substitute such course(s).
- b) A candidate may not fail a repeat course or fail more than three courses. If a candidate has failed courses yielding 80 credits or more her/his registration for the degree may be cancelled, unless the Senate is satisfied that there are exceptional circumstances.
- c) In exceptional circumstances the Senate may permit a candidate who has submitted a *Research Report* that is not satisfactory to submit a new report on a different topic.

3) Master of Science in Development Planning

For the award of the Master of Science in Development Planning candidates are required to pass courses included in the curriculum yielding a minimum of 180 credits.

4) Master of Science in Engineering

- a) A candidate must pass all the courses including the *Research Report*. The *Research Report* must demonstrate an acquaintance with the methods of research and be satisfactory as regards literary style.
- b) A candidate must pass every course, including the *Research Report*, at the first attempt, provided that, in circumstances considered by the Senate to be exceptional, a candidate may be permitted to repeat one course only or to substitute another course in lieu of the course that s/he failed and the Senate may permit a candidate who has submitted a *Research Report* that is not satisfactory to revise the report subject to such conditions as the Senate may apply in her/his case.

5) Master of Science in Aeronautical Engineering

- a) A candidate must pass all the courses including the *Research Report*. The *Research Report* must demonstrate an acquaintance with the methods of research and be satisfactory as regards literary style.

- b) A *candidate* must pass every *course*, including the *Research Report*, at the first attempt, provided that, in circumstances considered by the *Senate* to be exceptional, a *candidate* may be permitted to repeat one *course* only or to substitute another *course* in lieu of the *course* that s/he failed and the *Senate* may permit a *candidate* who has submitted a *Research Report* that is not satisfactory to revise the report subject to such conditions as the *Senate* may apply in her/his case.

- c) For the Dual degree, a *candidate* must satisfy all the requirements of both the University of the Witwatersrand and Embry-Riddle Aeronautical University.

6) Master of Science in Engineering Management

- a) A *candidate* must pass all the *courses* including the *Research Report*. The *Research Report* must demonstrate an acquaintance with the methods of research and be satisfactory as regards literary style.

- b) A *candidate* must pass every *course*, including the *Research Report*, at the first attempt, provided that, in circumstances considered by the *Senate* to be exceptional, a *candidate* may be permitted to repeat one *course* only or to substitute another *course* in lieu of the *course* that s/he failed and the *Senate* may permit a *candidate* who has submitted a *Research Report* that is not satisfactory to revise the report subject to such conditions as the *Senate* may apply in her/his case.

7) Master of Science in Industrial Engineering

- a) A *candidate* must pass all the *courses* including the *Research Report*. The *Research Report* must demonstrate an acquaintance with the methods of research and be satisfactory as regards literary style.

- b) A *candidate* must pass every *course*, including the *Research Report*, at the first attempt, provided that, in circumstances considered by the *Senate* to be exceptional, a *candidate* may be permitted to repeat one *course* only or to substitute another *course* in lieu of the *course* that s/he failed and the *Senate* may permit a *candidate* who has submitted a *Research Report* that is not satisfactory to revise the report subject to such conditions as the *Senate* may apply in her/his case.

8) Master of Science in Mechanical Engineering

- a) A *candidate* must pass all the *courses* including the *Research Report*. The *Research Report* must demonstrate an acquaintance with the methods of research and be satisfactory as regards literary style.

- b) A *candidate* must pass every *course*, including the *Research Report*, at the first attempt, provided that, in circumstances considered by the *Senate* to be exceptional, a *candidate* may be permitted to repeat one *course* only or to substitute another *course* in lieu of the *course* that s/he failed and the *Senate* may permit a *candidate* who has submitted a *Research Report* that is not satisfactory to revise the report subject to such conditions as the *Senate* may apply in her/his case.

9) Master of Science in Systems Engineering

- a) A *candidate* must pass all the *courses* including the *Research Report*. The *Research Report* must demonstrate an acquaintance with the methods of research and be satisfactory as regards literary style.

- b) A *candidate* must pass every *course*, including the *Research Report*, at the first attempt, provided that, in circumstances considered by the *Senate* to be exceptional, a *candidate* may be permitted to repeat one *course* only or to substitute another *course* in lieu of the *course* that s/he failed and the *Senate* may permit a *candidate* who has submitted a *Research Report* that is not satisfactory to revise the report subject to such conditions as the *Senate* may apply in her/his case.

10) Master of Science in Bulk Solids Handling

- a) A *candidate* must pass all the *courses* including the *Research Report*. The *Research Report* must demonstrate an acquaintance with the methods of research and be satisfactory as regards literary style.
- b) A *candidate* must pass every *course*, including the *Research Report*, at the first attempt, provided that, in circumstances considered by the *Senate* to be exceptional, a *candidate* may be permitted to repeat one *course* only or to substitute another *course* in lieu of the *course* that s/he failed and the *Senate* may permit a *candidate* who has submitted a *Research Report* that is not satisfactory to revise the report subject to such conditions as the *Senate* may apply in her/his case.

11) Master of Engineering (Professional)

- a) A *candidate* must pass all the *courses* including the Research/Industrial Project.
- b) The Research/Industrial Project must demonstrate an acquaintance with the methods of research and be satisfactory as regards literary style.
- c) A *candidate* who fails to pass any *course* (or *courses*) may repeat any such *course* (or *courses*) or substitute another *course* (or *courses*) for it but may not obtain more than 40 *credits* either by repeating *courses*, or substituting *courses* or both, unless the *Senate* otherwise determines in a case considered by it to be exceptional.
- d) In exceptional circumstances the *Senate* may permit a *candidate* who has submitted a Research/Industrial Project that is not satisfactory to submit a revised report subject to such conditions as the *Senate* may apply in her/his case.

12) Master of Urban Design

- a) A *candidate* shall be required to pass every *course* at the first attempt, provided that the *Senate* may, in a case considered by it to be exceptional, permit a *candidate* who has failed a *course* to repeat it.
- b) In exceptional circumstances the *Senate* may permit a *candidate* who has submitted a *Research Report* that is not satisfactory to submit a revised report.

13) Master of Urban Studies

- a) A *candidate* who fails a core *course* may be permitted to repeat such *course* once; a *candidate* who fails an elective *course* may be permitted either to repeat such *course* or to select an alternative elective *course*.
- b) A *candidate* may not fail more than one *course* or fail a repeat *course*.
- c) In exceptional circumstances the *Senate* may permit a *candidate* who has submitted a *Research Report* that is not satisfactory to submit a revised report.

3.4 Conversion

1) Conversion from Master of Science or a Master of Science in Engineering (by Coursework and a Research Report) to Master of Engineering or vice versa

A person who has been admitted to the Master of Science in Engineering (by coursework and a *Research Report*) or Master of Engineering may at any time before s/he satisfies the requirements for such *qualification* be permitted by the *Senate* to proceed instead as a *candidate* for the other *qualification*.

- a) Such a person shall have performed to the satisfaction of the *Senate* during her/his *candidature* for the *qualification* for which s/he is currently registered.

- b) For a person converting to a Master of Science or a Master of Science in Engineering by coursework and a *Research Report*, in addition to (a) above, such a person must meet all requirements for the MSc / MSc (Eng) namely: complete advanced coursework consisting of core and elective *courses* with *credits* yielding not fewer than 90 *credits* and submit a *Research Report*.
- c) For a person converting to a Master of Engineering, in addition to (a) above, such a person must meet all requirements for the MEng namely: complete advanced coursework consisting of core and elective *courses* with *credits* yielding not fewer than 90 *credits* and submit a Research/Investigational Project.

3.5 Prerequisite and corequisite rules

1) Restriction on courses: prerequisite and corequisite requirements

A. Course	B. Prerequisite	C. Corequisite
MECN7008A Financial Management	MECN7011A	
MECN7033A Automotive Engineering		MECN7028A
MECN7053A Systems Engineering Management	MECN7058A	
MECN7055A Requirements Analysis in Systems Engineering	MECN7058A	
MECN7056A Systems Engineering: Architecture	[MECN7058A and MECN 7055A]	
MECN7063A Systems Engineering – Modelling and Simulation: Principles and Approaches	MECN7058A	
MECN7064A Systems Engineering: Integration, Verification and Validation	MECN7058A	

3.6 Doctorates and Senior Doctorates

Qualification Name	Programme Code	NQF level
Doctor of Philosophy: PhD	EDA02 / FDA00	10
Doctor of Architecture: DArch	FD005	10
Doctor of Engineering: DEng	EDA00	10
Doctor of Town and Regional Planning: D (Town and Regional Planning)	FDA06	10
Doctor of Science in Architecture: DSc (Arch)	FD001	10
Doctor of Science in Building: DSc (Building)	FD004	10
Doctor of Science in Engineering: DSc (Eng)	ED001	10
Doctor of Science in Quantity Surveying: DSc (Quantity Surveying)	FD002	10
Doctor of Science in Town and Regional Planning: DSc (Town and Regional Planning)	FD003	10

3.6.1 Admission Rules

3.6.1.1 Doctor of Philosophy

Any one of the following may be admitted as a *candidate* for the Doctor of Philosophy, provided that the *Senate* is satisfied that the *candidate* is qualified to undertake the proposed line of research:

- a) a Master of Architecture of this University;
- b) a Master of Architecture (Professional) of this University;
- c) a Master of Engineering of this University;
- d) a Master of Environmental Planning of this University;
- e) a Master of Science in Building or Construction Management of this University;
- f) a Master of Science in Engineering of this University;
- g) a Master of Science in Quantity Surveying of this University;
- h) a Master of Science in Town and Regional Planning of this University;
- i) a Master of Urban Design of this University;
- j) by special permission of the *Senate*, a Bachelor of Architecture, a Bachelor of Science in Quantity Surveying, a Bachelor of Science in Town and Regional Planning, a Bachelor of Science in Building or Construction Management or a Bachelor of Science in Engineering of this University who either attained in her/his degree such standard as the *Senate* may require for this purpose or has held one of these degrees for a minimum of ten years;
- k) a graduate of this or any other university who in the opinion of the *Senate* holds a *qualification* equivalent to the status of any of the degrees mentioned in paragraph (a), (b), (c), (d), (e), (f), (g), (h), (i) or (j) and provided that the *Senate* has determined that the academic discipline in which the degree was obtained is relevant to the research which s/he wishes to undertake;
- l) a person who has in any other manner satisfied the *Senate* that s/he is so qualified.

3.6.1.2 Senior Doctorates

1) Doctor of Architecture

Any of the following may be admitted by the *Senate* as a *candidate* for the Doctor of Architecture:

- a) a Master of Architecture or a Bachelor of Architecture of this or *another university* who has held the *qualification* for a minimum of five years; or
- b) a Doctor of Philosophy of this or *another university* who has held that *qualification* for a minimum of three years; or
- c) a person who has obtained at any university or institution such *qualifications* as, in the opinion of the *Senate*, are equivalent to or higher than the qualifications mentioned in (a) or (b) above and who has held the qualification for a period of a minimum of five years.

2) Doctor of Engineering

Any of the following may be admitted by the *Senate* as a candidate for the Doctor of Engineering:

- a) a Master of Science in Engineering or a Master of Engineering of this or *any other University* of a minimum of five years standing or who has held the Bachelor of Science in Engineering for a minimum of six years; or
- b) a Doctor of Philosophy of this or *any other University* of a minimum of three years standing; or
- c) a person who has obtained at any university or institution such *qualifications* as, in the opinion of the *Senate*, are equivalent to or higher than the *qualifications* mentioned in (a) or (b) above and who has held the *qualification* for a period of a minimum of five years.

3) Doctor of Science in Architecture

Any of the following may be admitted by the *Senate* as a *candidate* for the Doctor. of Science in Architecture:

- a) a Master of Architecture or a Master of Urban Design or a Bachelor of Architecture of this or *another university* who has held that *qualification* for a minimum of five years; or
- b) a Doctor of Philosophy of this or *another university* who has held that *qualification* for a minimum of three years; or
- c) a person who has obtained at any university or institution such *qualifications* as, in the opinion of the *Senate*, are equivalent to or higher than the *qualifications* mentioned in (a) or (b) above and who has held the *qualification* for a period of a minimum of five years.

4) Doctor of Science in Building

Any of the following may be admitted by the *Senate* as a candidate for the Doctor of Science in Building:

- a) a Master of Science in Building or a Bachelor of Science in Building or Construction Management of this or *another university* who has held that *qualification* for a minimum of five years; or
- b) a Doctor of Philosophy of this or *another university* who has held that *qualification* for a minimum of three years; or
- c) a person who has obtained at any university or institution such *qualifications* as, in the opinion of the *Senate*, are equivalent to or higher than the *qualifications* mentioned in (a) or (b) above and who has held the *qualification* for a period of a minimum of five years.

5) Doctor of Science in Engineering

Any of the following may be admitted by the *Senate* as a candidate for the Doctor of Science in Engineering:

- a) a Master of Science in Engineering or a Master of Engineering of this or any other *University* of a minimum of five years' standing or who has held the Bachelor of Science in Engineering for a minimum of six years; or
- b) a Doctor of Philosophy of this or any other *University* of a minimum of three years' standing; or
- c) a person who has obtained at any other *university* or institution such *qualifications* as in the opinion of the *Senate* are equivalent to or higher than the *qualifications* mentioned in (a) or (b) above and who has held the *qualifications* for a period of a minimum of five years.

6) Doctor of Science in Quantity Surveying

Any of the following may be admitted by the *Senate* as a candidate for the Doctor of Science in Quantity Surveying:

- a) a Master of Science in Quantity Surveying or a Bachelor of Science in Quantity Surveying of this or *another university* who has held that *qualification* for a minimum of five years; or
- b) a Doctor of Philosophy of this or *another university* who has held that *qualification* for a minimum of three years; or
- c) a person who has obtained at any university or institution such *qualifications* as, in the opinion of the *Senate*, are equivalent to or higher than the *qualifications* mentioned in (a) or (b) above and who has held the *qualification* for a period of a minimum of five years.

7) Doctor of Science in Town and Regional Planning

Any of the following may be admitted by the *Senate* as a candidate for the Doctor of Science in Town and Regional Planning:

- a) Master of Science in Town and Regional Planning or a Bachelor of Science in Town and Regional Planning of this or *another university* who has held that *qualification* for a minimum of five years; or

- b) a Doctor of Philosophy of this or *another university* who has held that *qualification* for a minimum of three years; or
- c) a person who has obtained at *any university* or institution such *qualifications* as, in the opinion of the *Senate*, are equivalent to or higher than the *qualifications* mentioned in (a) or (b) above and who has held the *qualification* for a period of a minimum of five years.

8) Doctor of Urban and Regional Planning

Any of the following may be admitted by the *Senate* as a *candidate* for the Doctor of Town and Regional Planning:

- a) A Master of Science in Town and Regional Planning or a Bachelor of Science in Town and Regional Planning of this or *another university* who has held the *qualification* for a minimum of five years; or
- b) a Doctor of Philosophy of this or *another university* who has held that *qualification* for a minimum of three years; or
- c) a person who has obtained at *any university* or institution such *qualifications* as, in the opinion of the *Senate*, are equivalent to or higher than the *qualifications* mentioned in (a) or (b) above and who has held the *qualification* for a period of a minimum of five years.

3.6.2 Completion Rules

3.6.2.1 Doctor of Philosophy

1) Length of qualification and supervision

A *candidate* shall conduct full-time research under the guidance of a supervisor approved by the *Senate* either in the *University* or any other institution deemed by the *Senate* to be part of the *University* for this purpose, for a minimum of two academic years: Provided that–

- a) the *Senate* may dispense with this requirement in the case of a *candidate* who holds an appointment as a member of the full-time academic staff of the *University* and has held such appointment for a minimum of three years;
- b) in the case of a Master of Architecture, a Master of Science in Quantity Surveying, a Master of Science in Town and Regional Planning, a Master of Science in Building, a Master of Engineering or a Master of Science in Engineering of the *University*, the *Senate* may permit the substitution of part- time research for full-time research on the basis of two years of part-time research for one year of full-time research;
- c) the *Senate* may permit a *candidate* to conduct her/his research outside the *University* for such portion of the prescribed period and in such manner as the *Senate* may determine.

2) Requirement to attend courses

The *Senate* may require a *candidate* to attend such advanced *courses* of instruction as it considers to be cognate to the subject of her/his research.

3) Conditions for the award of PhD

A *candidate* for the Doctor of Philosophy shall –

- a) present for the approval of the *Senate* a thesis which must constitute a substantial contribution to the advancement of knowledge in the subject chosen, which thesis must be satisfactory as regards literary presentation;
- b) present himself/herself for such assessment as the *Senate* may determine.

3.6.2.2 Conditions for the award of the qualification of Senior Doctor

1) Doctor of Architecture, Doctor of Town and Regional Planning

A *candidate* for the Doctor of Architecture or Doctor of Town and Regional Planning must present for the approval of the *Senate* original published work, or original work accepted for publication, on a subject approved by the *Senate* which work must constitute a distinguished contribution to the advancement of knowledge in the subject chosen, must be a record of development work of major scientific, economic or social significance carried out under the technical direction of the *candidate*, and which must also constitute a major advance in the application of knowledge in architectural practice, or town and regional planning practice, as the case may be.

2) Doctor of Engineering

A *candidate* must present for the approval of the *Senate* original published work, or original work accepted for publication, on a subject approved by the *Senate* which work must be a record of engineering development of major technological, economic or social significance carried out under the technical direction of the *candidate*, and which constitutes a distinguished contribution to the practice of engineering.

3) Doctor of Science in Architecture, Doctor of Science in Building, Doctor of Science in Engineering, Doctor of Science in Quantity Surveying and Doctor of Science in Town and Regional Planning

A *candidate* for the Doctor of Science in Architecture, Doctor of Science in Building, Doctor of Science in Engineering, Doctor of Science in Quantity Surveying or Doctor of Science in Town and Regional Planning, as the case may be, shall present for the approval of the *Senate* original published work, or original work accepted for publication, on a subject approved by the *Senate*, which work must constitute a distinguished contribution to the advancement of knowledge in the subject chosen and must be a record of original research work undertaken by the *candidate*.

3.6.2.3 Professional Status and Recognition of Degrees

The Bachelor of Architectural Studies (BAS) degree qualifies the graduate for registration with the South African Council for Architectural Professions (SACAP) as a Candidate Architectural Technologist, and is equivalent to CAA Part 1. The Bachelor of Architectural Studies Honours (BAS Hons) qualifies the graduate for registration with SACAP as Candidate Senior Architectural Technologist and the postgraduate Master of Architecture (Professional) - MArch (Prof) qualifies the graduate for registration as a Candidate Professional Architect, and is equivalent to CAA Part 2. After two years of work in the offices of a registered architect the Candidate Professional Architect may qualify for registration as an architect with the SACAP.

The BAS, BAS Hons and MArch (Prof) degree are validated by the SACAP, and the BAS and March (Prof) also by the Commonwealth Association of Architects.

The degrees of Bachelor of Science (Urban and Regional Planning), Bachelor of Science Honours (Urban and Regional Planning) and Master of Science (Development Planning) are recognised for professional accreditation by the South African Council of Planners (SACPLAN). Registration with the Council after two years of supervised practical experience is a statutory requirement in order to practise.

The Bachelor of Science Honours (Quantity Surveying) degrees are accredited by the South African Council for the Quantity Surveying Profession, the Royal Institution of Chartered Surveyors (RICS) and the Chartered Institute of Building (CIOB).

Graduates in Construction Management are eligible to register as *candidate* Construction or Project Managers with the South African Council for Project and Construction Management Professions (SACPCMP). Three years of the in-service training must be completed under the supervision of a registered professional Construction or Project Manager before a candidate may register as a Professional Construction or Project Manager.

Graduates in Construction Management are eligible for corporate membership of the Chartered Institute of Building without further examination.

The Bachelor of Science (Construction Studies) and Bachelor of Science Honours (Construction Management) degrees are accredited by SACPCMP, RICS and CIOB.

The Bachelor of Science in Engineering award is accepted by the Engineering Council of South Africa (ECSA) as fulfilling all the academic requirements for registration as a Professional Engineer.

Acting in terms of the Engineering Profession of South Africa Act 1990, ECSA has stipulated a minimum period of three years' appropriate practical training and experience under the guidance of a professional engineer before a *candidate* may register as a Professional Engineer. This period may be reduced by up to one year in recognition of successful postgraduate degree work. It is of the utmost importance that every graduate should register as a 'candidate engineer' immediately after graduation. Engineering graduates of the *University* may be admitted without further examination to membership of the following professional institutions (voluntary associations) appropriate to their branch of engineering, after a period of practical experience:

The Aeronautical Society of South Africa

The South African Institution of Chemical Engineers

The South African Institution of Civil Engineers

The South African Institute of Electrical Engineers

The Southern African Institute for Industrial Engineering

The South African Institution of Mechanical Engineering

The South African Institute of Mining and Metallurgy

The South African Institution of Certificated Engineers

Graduates in the relevant branches of engineering are eligible for exemptions from certain parts of the examinations for Government Certificates of Competency.

Graduates in Mining Engineering are exempted from three of the five years' practical experience required before becoming eligible for examination for the Government Mine Managers' Certificate of Competency, and are also exempted from certain parts of that examination.

Graduates in Mechanical Engineering and Electrical Engineering may be exempted from three years of the period of practical experience and certain of the examinations required by the Commissioner of Examiners for the Mechanical and Electrical Engineering Certificates of Competency.

In terms of the Washington Accord signed in June 2000, of which South Africa is a signatory, official recognition of our engineering qualifications has been approved by professional engineering accrediting bodies in the US, Canada, Australia, New Zealand, the UK, Ireland, Japan and Hong Kong.

Note: Bachelor of Engineering Science in Biomedical Engineering is not a professional degree.

OUTCOMES FOR THE FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

The University aspires for its students to achieve the following outcomes upon qualifying. The outcomes and assessment criteria listed are those, for each qualification of the University, as agreed by the Senate.

4.1 The Built Environment

4.1.1 Degrees of Bachelor

4.1.1.1 Bachelor of Architectural Studies [BAS]

Qualification Title	Bachelor of Architectural Studies
Qualification Abbreviation	BAS
Minimum Period of Study	3 years full-time
NQF Exit Level	Level 7
NQF Credits	Total minimum 540

Exit Level Outcome 1

The qualifying *student* is able to present material using effective and appropriate visual techniques in two and three dimensions.

Associated Assessment Criteria

The qualifying *student* can demonstrate ability to:

- represent creative ideas, and
- produce technical drawings;

both

- manually, and
- using computer technology in two and three dimensions.

Exit Level Outcome 2

The qualifying *student* will have a grounding in certain fields of knowledge, and will develop critical, analytical thinking to appreciate, research and interpret existing knowledge.

Associated Assessment Criteria

The qualifying *student* demonstrates:

- an ability to analyse and interpret knowledge critically in appropriate fields;
- competence in research methods;
- the ability to analyse and evaluate research material.

Exit Level Outcome 3

The qualifying *student* shows design and problem solving competencies.

Associated Assessment Criteria

The qualifying *student* demonstrates:

- design ability;
- an ability to frame design questions critically;
- competence to evaluate and address questions through creative and responsible decision making.

Exit Level Outcome 4

The qualifying *student* is able to communicate appropriately and effectively.

Associated Assessment Criteria

The qualifying *student* demonstrates:

- mathematical competence (at NQF Level 5);
- competence at communicating ideas and information to people from a wide range of backgrounds;
 - in writing;
 - visually;
 - orally.

Exit Level Outcome 5

The qualifying *student* has the capacity for independent thought and practice.

Associated Assessment Criteria

The qualifying *student* demonstrates skills of time management, prioritisation and initiative in order to perform adequately all facets of the programme.

Exit Level Outcome 6

The qualifying *student* has experience working in groups with peers and s/he has worked directly with communities in a consultative role.

Associated Assessment Criteria

The qualifying *student* demonstrates collaborative, group participation and consultative skills.

Exit Level Outcome 7

The qualifying *student* is familiar with current technological knowledge in the field of study and its related disciplines.

Associated Assessment Criteria

The qualifying *student* demonstrates:

- familiarity with current technological norms and practices; and is able to
- select, and
- develop sustainable technological and environmental approaches to different contexts.

Exit Level Outcome 8

The qualifying *student* has developed an understanding of the wider social and natural systems that impact on the field of study, and has developed an appreciation for cultural and aesthetic diversity.

Associated Assessment Criteria

The qualifying *student* demonstrates:

- an integrated approach to the field of study;
- knowledge of the social, cultural, economic and environmental contexts;
- an understanding of the implications of decisions taken.

Exit Level Outcome 9

The qualifying *student* reflects and acts on a wide range of learning strategies, both existing and innovative. The *student* is encouraged to reflect on his/her professional and ethical relationship with communities and individuals.

Associated Assessment Criteria

The qualifying *student* demonstrates:

- the ability to engage in critical assessment of current teaching and learning practice;
- of the discipline and related fields;
- of personal work practices and future career paths;
- an ethical and professional approach.

4.1.1.2 Bachelor of Science in Construction Studies [BSc(Construction Studies)]

Qualification Title	Bachelor of Science in Construction Studies
Qualification Abbreviation	BSc (Construction Studies)
Minimum Period of Study	3 years full-time
NQF Exit Level	Level 7
NQF Credits	Total minimum 418

Exit Level Outcomes

- The *student* is competent to identify, analyse and solve problems in the field of construction assembly and management of the process.
- The *student* is competent to manage the construction of buildings and related infrastructure; manage the resources within project management and within the organisation; understand and evaluate economic issues concerning the property construction sector at both a micro and macro level.
- Communicate effectively on all matters in construction to which his/her skills and competencies apply.
- Use and apply information technology generally and specific technologies to construction.
- Apply knowledge of technology within the context of the built environment including consideration of interdisciplinary aspects.

Associated Assessment Criteria

- The *student* demonstrates an ability to:
- apply engineering principles to construction of building and civil engineering structures, foundations, walls, roofs drainage and water supply and disposal, power supply and distribution, acoustic and thermal performance of structures
- communicate concepts, ideas, theories through mathematical, statistical, verbal and written means to engineers, architects, quantity surveyors, property developers and clients
- deal with uncertainty and risk through the use of probability and statistics
- assess the implications for success of a project of the properties of construction materials and their manner of use.
- The *student* demonstrates knowledge of the following:
- ability to apply knowledge of management techniques to personnel management on the construction site and in the corporate office
- deal with architects, contractors, engineers, quantity surveyors, property developers clients, local and regional authorities
- the formation of work teams, conducting and participating in meetings, analysis of team performance and motivation
- total quality management issues
- professional ethics and social responsibility
- The *student* is able to:

Demonstrate knowledge of concepts by effective writing and formatting of essays, letters and reports: demonstrate excellence in spelling/grammar/use of vocabulary/citing and referencing sources; speaking: display excellence in language; listen attentively to information which may be conveyed via a variety of media: develop discernment through effective listening; use and interpret basic techniques of graphical communication; plans/diagrams/maps drawn to various scales and/or other visual aids.

- Use information systems with competence, including the use of relevant software systems, management packages, general construction/design packages and communication systems.

- Participate in teamwork; recognise the roles, motives and viewpoints of team members; develop leadership qualities, and is knowledgeable of physical, social and cultural environments and management.
- Use appropriate, effective techniques to elicit or obtain information; listen and comprehend the import of audio-visual communication.

4.1.1.3 Bachelor of Science in Urban and Regional Planning [BSc(URP)]

Qualification Title	Bachelor of Science in Urban and Regional Planning
Qualification Abbreviation	BSc(URP)
Minimum Period of Study	3 years full-time
NQF Exit Level	Level 7
NQF Credits	Total minimum 360

Exit Level Outcome 1

The qualifying *student* understands planning and development issues important to the South African context.

Associated Assessment Criteria

The qualifying *student* demonstrates:

- her/his knowledge of the extensive, diverse heritage of indigenous human settlement and culture in Africa;
- her/his knowledge of the historical and current theoretical planning models and approaches for industrialised and developmental contexts;
- a practical and theoretical grounding in physical planning and design.

Exit Level Outcome 2

The qualifying *student* has knowledge of how to manage uncertainty within a changing temporal, socio-economic, political and environmental context.

Associated Assessment Criteria

The qualifying *student* demonstrates:

- the ability to identify and address complex problems by employing
 - appropriate procedural planning theories,
 - appropriate procedural planning theories,
 - concepts, and
 - quantitative or other planning techniques in dealing with them;
- his/her individual skills in the investigation of a specialised area of planning, by defining the problem or issue, analysing it through the exploration of relevant theory and solving it by developing a set of practical proposals;
- familiarity with resource allocation issues and demonstrates the ability to apply project budgeting and financial viability and implementation strategies;
- the ability to apply the concept of sustainability to socio-economic, historical, political, cultural and legal issues affecting the physical and natural urban or rural environment.

Exit Level Outcome 3

The qualifying *student* is able to cope with South Africa's diverse social and cultural dynamics.

Associated Assessment Criteria

The qualifying *student* demonstrates competency in the skills necessary to deal with the complexities of:

- multi-disciplinary team-work;
- field research;

- academic exercises and design work;
- work in projects involving community participation.

Exit Level Outcome 4

The qualifying *student* understands planning as part of wider social, political, cultural, administrative, economic and natural systems, and their operating and financial characteristics.

Associated Assessment Criteria

The qualifying *student* demonstrates:

- knowledge of the structural and operating characteristics of infra-structural and other systems and the limitations these impose on development;
- an understanding of planning and its role in society;
- critical, analytical and creative thinking abilities in order to appreciate, interpret, research, refine, apply and augment the existing body of knowledge and understanding in planning.

Exit Level Outcome 5

The qualifying *student* can research, analyse and interpret information in different ways and can effectively communicate its significance to different types of audience.

Associated Assessment Criteria

The qualifying *student* demonstrates:

- an ability to use;
 - mathematical, visual, graphic, verbal and writing skills in thinking and communicating,
 - IT (especially CAD and GIS) and manual graphics;
- so as to investigate and interpret the spatial and temporal dimensions of planning and planning issues
- competence in qualitative and quantitative research methods and can interpret and evaluate research material.

Exit Level Outcome 6

The qualifying *student* has been prepared both for the next stage of his/her career, whether it be professional, entrepreneurial or in some other field, and to meet the demands of continuing professional and life-long development.

Associated Assessment Criteria

The qualifying *student* will have been exposed to a range of alternative career paths he or she may wish to follow, through exposure to staff, business people, planning professionals and fellow *students*.

4.1.1.4 Bachelor of Science in Property Studies [BSc(Property Studies)]

Qualification Title	Bachelor of Science in Property Studies
Qualification Abbreviation	BSc(Property Studies)
Minimum Period of Study	4 years full-time
NQF Exit Level	Level 8
NQF Credits	Total minimum 480

Exit Level Outcomes

It is expected that the graduate will be able to:

- Identify structure and analyse problems, evaluate alternative strategic options, design and propose solutions and exercise professional judgement in the consideration of alternatives in complex construction situations and provide informational support for decisions;
- Develop coherent and consistent argument and communicate ideas clearly, concisely and logically in spoken, written numerical and graphical form, as appropriate;

- Research, interpret and evaluate information, critically appraise current attitudes and methods and develop a creative and innovative approach to the discipline of property;
- Develop an awareness of the significance and scope of many areas of specialism involved in, and the extent of the specialist contribution to, the overall construction industry;
- Develop an awareness of the cultural, ethical, moral and professional constraints which affect the extent to which ever changing demands can be accommodated with specific projects;
- Develop an awareness of the opportunity that exist or may appear in the future, for the development of individual career prospects on the development of the property profession.

4.1.2 Degrees of Bachelor with Honours

4.1.2.1 Bachelor of Architectural Studies with Honours [BASHons]

Qualification Title	Bachelor of Architectural Studies with Honours
Qualification Abbreviation	BASHons
Minimum Period of Study	1 year full-time or 2 years part-time
NQF Exit Level	Level 8
NQF Credits	Total minimum 120

Exit Level Outcome 1

The qualifying *candidate* has developed an understanding of a broad range of fields of knowledge appropriate to the discipline of architecture, and critical analytical thinking to appreciate, research, interpret, refine and modify existing knowledge.

Associated Assessment Criteria

The qualifying *candidate*:

- shows ability to analyse and interpret knowledge critically in appropriate fields;
- Shows the ability to analyse and evaluate research material;
- is able to engage in critical debate in the field of study.

Exit Level Outcome 2

The qualifying *candidate* has a working knowledge of and skills in the methodology/s and practice of architectural research.

Associated Assessment Criteria

The qualifying *candidate*:

- shows an understanding of different research methodologies appropriate to architecture;
- demonstrates competence in a field of architectural research, both individually and as member of a team.

Exit Level Outcome 3

The qualifying *candidate* shows general design and problem solving competencies and is able to apply them in a number of specialist applications.

Associated Assessment Criteria

The qualifying *candidate* is able to:

- frame design questions critically;
- design;
- evaluate and address questions through creative and responsible decision making;
- apply design processes in a number of specialist contexts.

Exit Level Outcome 4

The qualifying *candidate* is familiar with current technological knowledge in the field of study and its related disciplines.

Associated Assessment Criteria

The qualifying *candidate* is:

- familiar with current technological norms and practices; and is able to
- research;
- select; and
- develop sustainable technological and environmental approaches to different contexts.

Exit Level Outcome 5

The qualifying *candidate* is able to communicate appropriately and effectively.

Associated Assessment Criteria

The qualifying *candidate* demonstrates competence at communicating ideas and information to people from a wide range of backgrounds.

- orally;
- in writing;
- visually; With the assistance of
- manual; and
- computer technology.

Exit Level Outcome 6

The *candidate* is able to present material using effective and appropriate visual techniques in two and three dimensions.

Associated Assessment Criteria

The qualifying *candidate* can:

- represent creative ideas; and
 - produce technical drawings;
- both
- manually; and
 - using computer technology in two and three dimensions.

Exit Level Outcome 7

The qualifying *candidate* demonstrates self-directed, independent thought and practice.

Associated Assessment Criteria

In order to perform adequately in addressing all facets of the programme the qualifying *candidate* shows time management, prioritisation and initiative. The qualifying *candidate* is able to define and tackle a problem within a generally defined framework.

Exit Level Outcome 8

The qualifying *candidate* has experience in group work with peers and is able to worked directly with communities in a consultative role.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- the ability to consult and collaborate with people from a range of backgrounds;
- the ability to participate in group work effectively.

Exit Level Outcome 9

The qualifying *candidate* has developed an understanding of the wider social and natural systems which impact on the field of study and has developed an appreciation for cultural and aesthetic diversity.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- an integrated approach to the field of study;
- knowledge of social, cultural, economic and environmental contexts;
- understanding of the implications of decisions taken.

Exit Level Outcome 10

The qualifying *candidate* reflects and acts upon a wide range of learning strategies, both existing and innovative.

Associated Assessment Criteria

The qualifying *candidate* shows:

- the ability to engage in critical assessment of current teaching and learning practice of the discipline and related fields;
- the ability to reflect upon and improve individual work practices.

4.1.2.2 Bachelor of Science with Honours in Construction Management [BScHons(CM)]

Qualification Title	Bachelor of Science with Honours in Construction Management
Qualification Abbreviation	BScHons(CM)
Minimum Period of Study	1 year full-time
NQF Exit Level	Level 8
NQF Credits	Total minimum 120

Exit Level Outcomes

Upon completion of the BSc Honours (Construction Management) programme, the graduate is competent to:

- identify, assess and solve open-ended project management/construction related problems creatively and innovatively within limits of own knowledge;
- perform basic construction trade skills;
- use computer packages for project management and construction related information processing;
- manage and prepare tender and contractual documents relating to construction projects;
- cost and undertake financial management of construction developments;
- manage the costs of the construction of buildings and related infrastructure;
- manage the human resources within project management or construction based organisations;
- understand and evaluate economic issues concerning the property construction sector at both a micro and macro level;
- understand the time value of money;
- communicate with clients and construction professional concerning spatial concepts, financial issues and construction assembly problems;
- communicate effectively in writing and orally with superiors, peers and subordinates;
- recognise the impact of construction activities on society and the environment;
- function successfully in a multi-disciplinary team;
- analyse and interpret data and derive information therefrom;
- appreciate the value of and be able to work effectively and efficiently;

- engage in lifelong learning and recognise this as an important professional value;
- recognise the need to act professionally and ethically within an area of competence;
- apply appropriate project management and construction management techniques to building and civil engineering projects;
- perform appropriate professional project and construction management functions;
- identify, analyse and solve problems in the field of construction assembly and management of the process;
- perform a number of potential roles within a constructor or project management organisation, after an appropriate period of practical experience;
- undertake research and produce reports.

Associated Assessment Criteria

On completion of the BSc (Hons) in Construction Management, the *candidate* is:

- Competent to identify, analyse and solve problems in the field of construction assembly and management of the process;
- Able to carry out basic cost accounting, costing systems and budgeting;
- Competent to recognise and deal with most labour and staff matters encountered in the working environment;
- Competent to read, understand and operate the standard contract document;
- Thoroughly knowledgeable of the principles and application of financial management;
- Considerably knowledgeable of the functions and activities of construction industry bodies;
- Familiar with the South African housing environment;
- Competent in research methodology and able to carry out research across a broad spectrum of subjects related to the building industry and produce clearly understood results.

4.1.2.3 Bachelor of Science with Honours in Quantity Surveying [BScHons(QS)]

Qualification Title	Bachelor of Science with Honours in Quantity Surveying
Qualification Abbreviation	BScHons(QS)
Minimum Period of Study	1 year full-time
NQF Exit Level	Level 8
NQF Credits	Total minimum 120

Exit Level Outcomes

Upon completion of the BSc Honours in Quantity Surveying programme, the graduate is competent to:

- identify, assess and solve open-ended quantity surveying/construction related problems creatively and innovatively within limits of own knowledge;
- perform basic construction trade skills;
- use computer packages for quantity surveying and construction related information processing;
- manage and prepare tender and contractual documents relating to construction projects;
- estimate cost and undertake financial management of construction developments;
- manage the costs of the construction of buildings and related infrastructure;
- manage the human resources within quantity surveying based organisations
- understand and evaluate economic issues concerning the property construction sector at both a micro and macro level;
- understand the time value of money and apply discounted cash flow techniques for evaluating alternatives property investments;
- communicate with clients and construction professionals concerning spatial concepts, financial issues and construction assembly problems;

- communicate effectively in writing and orally with superiors, peers and subordinates;
- recognise the impact of construction activities on society and the environment;
- function successfully in a multi-disciplinary team;
- analyse and interpret data and derive information therefrom;
- appreciate the value of and be able to work effectively and efficiently;
- engage in lifelong learning and recognise this as an important professional value;
- recognise the need to act professionally and ethically within an area of competence;
- undertake financial planning and control of new and existing facilities;
- undertake property development and property portfolio management;
- value property;
- apply appropriate quantity surveying techniques to building and civil engineering projects;
- perform appropriate professional quantity surveying management functions;
- undertake research and produce reports.

Associated Assessment Criteria

Statement of assessment criteria for exit-point qualification on the programme:

- Clear and logical problem solving skills - assessed by examinations (a, b);
- An ability to analyse both qualitatively and quantitatively - assessed by examination and class work (tutorials and practical reports) (a, k, m, n, u, x, y);
- An ability to produce design solutions in the fields of property and construction - assessed by examination and individual open ended projects with oral interrogation (c, d, e, f, h, i, j, r, s);
- An ability to work independently or in a team - assessed by practical work (g, k, m, v);
- An ability to extend the knowledge gained through instruction by independent study, thought, research, analysis and design - assessed through open ended projects with oral interrogation and written research dissertations with oral presentations and interrogation (a, k, n, o, p, w);
- Outcomes (l and q) are covered in specific modules which are assessed by examination);
- An overall mark of 50% for each module is required to obtain credit.

4.1.2.4 Bachelor of Science with Honours in Urban and Regional Planning [BScHons(URP)]

Qualification Title	Bachelor of Science with Honours in Urban and Regional Planning
Qualification Abbreviation	BScHons(URP)
Minimum Period of Study	1 year full-time
NQF Exit Level	Level 8
NQF Credits	Total minimum 120

Note: Although many of the outcomes are similar to those in the BSc (URP) the *candidate* will be expected to

achieve these outcomes at a higher or more advanced level than for the BSc (URP), and will be expected to display a higher level of integrative ability. In addition the *candidate* must meet the requirements of Exit Level Outcome 7.

Exit Level Outcome 1

The qualifying *candidate* has an advanced integrative understanding of development and planning issues important to the South African context.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- her/his advanced knowledge of the extensive, diverse heritage of indigenous and colonial human settlement and culture in Africa;
- her/his advanced knowledge of the historical and current theoretical planning models and approaches for industrialised and developmental contexts;
- an advanced practical and theoretical grounding in physical planning and design.

Exit Level Outcome 2

The qualifying *candidate* has knowledge of how to manage complexity and uncertainty within a changing temporal, socio-economic, political and environmental context as a professional planner, across scales ranging from the local to the national.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- the ability to identify and address complex problems by employing
 - appropriate procedural planning theories,
 - concepts,
 - quantitative or other planning techniques in dealing with them, and
 - making value choices;
- his/her individual skills in the investigation of a specialised area of planning, by defining the problem or issue, analysing it through the exploration of relevant theory and solving it by developing a set of practical proposals;
- the ability to deal with planning problems at scales ranging from the local to at least the national;
- familiarity with resource allocation issues and demonstrates the ability to apply project budgeting and financial viability and implementation strategies;
- the ability to apply the concept of sustainability to socio-economic, political, cultural and legal issues affecting the physical and natural urban or rural environment.

Exit Level Outcome 3

The qualifying *candidate* is able to cope with and plan within South Africa's diverse social and cultural dynamics.

Associated Assessment Criteria

The qualifying *candidate* demonstrates competency in the skills necessary to deal with the complexities of:

- multi-disciplinary team-work;
- field research;
- academic exercises and design work;
- work in projects involving community participation.

Exit Level Outcome 4

The qualifying *candidate* has an advanced understanding of planning as part of wider social, political, cultural, administrative, economic and natural systems, and their operating and financial characteristics.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- knowledge of the structural and operating characteristics of infra-structural and other systems and the limitations these impose on development;
- an understanding of planning and its role in society;

- critical, analytical and creative thinking abilities in order to appreciate, interpret, research, refine, apply and augment the existing body of knowledge and understanding in planning.

Exit Level Outcome 5

The qualifying *candidate* can research, analyse and interpret information in different ways and can effectively

communicate its significance to different types of audience.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- an ability to use;
 - mathematical, visual, graphic, verbal and writing skills in thinking and communicating,
 - IT (especially CAD and GIS) and manual graphics;
- so as to investigate and interpret the spatial and temporal dimensions of planning and planning issues;
- competence in qualitative and quantitative research methods and can interpret and evaluate research material.

Exit Level Outcome 6

The qualifying *candidate* has been prepared both for the next stage of his/her career, whether it be professional, entrepreneurial or in some other field, and to meet the demands of continuing professional and life-long development.

Associated Assessment Criteria

The qualifying *candidate* will have been exposed to a range of alternative career paths he or she may wish to

follow, through exposure to staff, business people, planning professionals and fellow *candidates*

Exit Level Outcome 7

The qualifying *candidate* is able to operate independently but within applicable professional, ethical and legal frameworks and to reflect on how this affects her/his roles as a planner.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- an understanding of how these frameworks influence the selection and application of appropriate procedures and roles within different contexts;
- the skills of time management, prioritisation and initiative in order to perform adequately in addressing all facets of the programme.

4.1.3 Degrees of Master

4.1.3.1 Master of Architecture [MArch]

Qualification Title	Master of Architecture
Qualification Abbreviation	MArch
Minimum Period of Study	1 year full-time or two years part-time
NQF Exit Level	Level 9
NQF Credits	Total minimum 180

Exit Level Outcome 1

The *candidate* is competent to identify, evaluate and solve problems within the ambit of the research area, and is required to demonstrate a high level of responsibility and ethics both within the immediate context of the problem, and with regard to society as a whole.

Associated Assessment Criteria

The *candidate* is able:

- to evaluate existing research and perform individual research;
- to communicate results at an international academic level;
- to solve problems in a wide range of economic and social contexts;
- to contribute significantly to the development of society through mastery of the research area.

Exit Level Outcome 2

The *candidate* is required to operate effectively in an academic environment with peers and supervisors. Where appropriate to the research area, the *candidate* is required to interact effectively with communities and other groups and individuals outside the academic arena.

Associated Assessment Criteria

The *candidate* demonstrates:

The importance of the exchange ideas and knowledge with peers and supervisors. The *candidate* is able:

- to distinguish between different styles of communication in the quest for information, and can apply these appropriately and effectively;
- to apply academic ethics and responsibility to all aspects of study and research.

Exit Level Outcome 3

The *candidate* is required to have extensive communication skills and the ability to produce material of an internationally acceptable standard.

Associated Assessment Criteria

The *candidate* understands a wide range of strategies for communicating in the pursuit of data collection, and in the transmission of the results of research.

The *candidate* demonstrates:

- exceptional command of communication in writing, orally, visually and using IT, and can apply these media appropriately in the presentation of research material;
- sensitivity to cultural diversity in using different modes of communicating, both in the collection of data and in presentation of the results of research.

Exit Level Outcome 4

The *candidate* will have built on his/her existing knowledge of technology and is able to evaluate the application of technology in relation to wider local and global environmental concerns.

Associated Assessment Criteria

The *candidate* is able:

- to evaluate, apply and develop existing and new technological approaches where appropriate to the research area;
- to locate technological issues within the research area to wider economic and social systems critically and ethically.

The *candidate* can respond sensitively to the choice of technology in varied cultural settings.

Exit Level Outcome 5

The *candidate* will be able to locate his/her decision making and proposals within wider social, legal, economic, intellectual and environmental contexts.

Associated Assessment Criteria

The *candidate* demonstrates:

- critical awareness of his/her role as researcher in society;
- knowledge of the legal frameworks pertaining to the research area, and is able to relate them to wider legal and ethical contexts;
- an understanding of the implications of society's expectations of research.

Exit Level Outcome 6

The *candidate* will have developed a high level of self-management with a critical awareness of personal values.

Associated Assessment Criteria

In addressing the requirements of the programme, the qualifying *candidate* shows time management, self-motivation, prioritisation and initiative at an advanced level.

Exit Level Outcome 7

The *candidate* is required to have extensive skills and knowledge in the area of data collection, analysis, organisation and evaluation.

Associated Assessment Criteria

The *candidate* shows:

- a working knowledge of different research methods,
 - understanding of the impact of research on subjects involved in it and society as a whole.
- The *candidate* is able to evaluate different methods of data manipulation within a range of scenarios, and understands the social and academic consequences of the choice of method.

Exit Level Outcome 8

The *candidate* is exposed to a range of sophisticated learning strategies, and is expected to make informed decisions on those employed. The *candidate* is required to act responsibly and professionally, with full regard to the needs and aspirations of the society within which s/he operates. The *candidate* has considerable cultural and aesthetic awareness, and is required to enhance and apply this within the area of specialisation.

The *candidate* is exposed to career opportunities both within an entrepreneurial and academic context.

Associated Assessment Criteria

The *candidate* is able to operate effectively in a professional and academic environment. The *candidate* demonstrates:

- cultural and aesthetic awareness and sensitivity;
- a wide range of strategies in the pursuit of his/her studies.

The *candidate* is aware of career opportunities open to him/her in both an academic and entrepreneurial context.

4.1.3.2 Master of Architecture (Professional) [MArch(Prof)]

Qualification Title	Master of Architecture (Professional)
Qualification Abbreviation	MArch(Prof)
Minimum Period of Study	1 year full-time or 2 years part-time
NQF Exit Level	Level 9
NQF Credits	Total minimum 180

Exit Level Outcome 1

The qualifying *candidate* demonstrates in depth knowledge appropriate to the discipline, and critical, analytical thinking to appreciate, research, interpret, refine and modify existing knowledge of architecture.

Associated Assessment Criteria

The qualifying *candidate*:

- shows ability to analyse and interpret knowledge critically;
- shows ability to analyse and interpret knowledge critically;
- shows the ability to analyse and evaluate research material;
- is able to engage in critical debate in the field of study;
- demonstrates competence in independent research.

Exit Level Outcome 2

The qualifying *candidate* demonstrate a knowledge of architectural research methods, skills in the practice of architectural research appropriate to a specific context and the ability to integrate architectural research and design.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- an understanding of architectural research methods and procedures;
- competence in a field of architectural research, both individually and as member of a team; and shows an ability to
- select and motivate an appropriate piece of architectural research in relation to a design thesis.

Exit Level Outcome 3

The qualifying *candidate* shows design competencies at a range of different scales, from the urban, to the level of architectural detailing.

Associated Assessment Criteria

The qualifying *candidate* is able to:

- frame design questions critically;
- produce and demonstrate coherent and well resolved architectural designs that integrate knowledge of the social, political, economic and professional context that guides building construction;
- evaluate and appraise design briefs critically to ensure that the design response is appropriate to site and context and for reasons such as sustainability and budget;
- and demonstrates competence in the areas of
- architectural design;
- technical design;
- urban design;

and demonstrates an appropriate philosophical approach which reveals an understanding of theory in a cultural context.

Exit Level Outcome 4

The qualifying *candidate* is familiar with current technological knowledge and is able to integrate it with design solutions.

Associated Assessment Criteria

The qualifying *candidate* is familiar with and able to integrate knowledge of

- current technological norms and practices;
- the principles and theories associated with visual, thermal and acoustic environments;
- sustainable design and the relationship between climate, built form, construction, life style,
- energy consumption and human well being;

and is able to

- research;
- select, and
- develop;

structural and constructional strategies for a complex building or group of buildings, employing integrative knowledge of:

- structural theories;
- construction techniques and processes;
- the physical properties of buildings materials;
- the provision of building services and;
- the environmental impact of specification choices in a sustainable manner.

Exit Level Outcome 5

The qualifying *candidate* is able to communicate appropriately and effectively.

Associated Assessment Criteria

The qualifying *candidate* demonstrates skill at communicating ideas and information to people from a wide range of backgrounds:

- orally;
- in writing; and
- graphically.

Exit Level Outcome 6

The *candidate* is able to present material using innovative, effective and appropriate visual techniques in two and three dimensions, showing a high level of technical competence.

Associated Assessment Criteria

The qualifying *candidate* can:

- represent creative ideas, and produce technical drawings;
- both
- manually, and
 - using computer technology innovatively and technically competently.

Exit Level Outcome 7

The qualifying *candidate* demonstrates self-directed, independent thought and practice.

Associated Assessment Criteria

In order to perform adequately in addressing all facets of the programme the qualifying *candidate* shows time management, prioritisation and initiative at a professional level. The qualifying *candidate* is able to define, motivate and tackle problems with initiative and in an independent manner.

Exit Level Outcome 8

The qualifying *candidate* has experience in group work with peers and is able to work directly with outside parties in a professional manner.

Associated Assessment Criteria

The qualifying *candidate* demonstrates professionalism in collaboration, group work and consultation with outside bodies.

Exit Level Outcome 9

The qualifying *candidate* has developed a broad understanding of the wider social and natural systems which impact on architecture and has developed an appreciation for cultural and aesthetic diversity.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- an understanding of the influences on the contemporary built environment of individual buildings, the design of cities, past and present societies and wider global issues;

- an understanding of the histories and theories of architecture and urban design, the history of ideas, and the related disciplines of art, cultural studies and landscape studies and its application in critical debate;
- an understanding of the implications of decisions taken on wider systems and the ability to critically appraise and form judgements about the qualities of a design (spatial, aesthetic, technical and social) within the scope of a wider environment;
- the values required for participation in society as a respected and respectful citizen.

Exit Level Outcome 10

The qualifying *candidate* reflects and acts upon a wide range of learning strategies, both existing and innovative.

Associated Assessment Criteria

The qualifying *candidate* shows:

- the ability to engage in critical assessment of current teaching and learning practice;
- the ability to evaluate and improve personal work practices;
- the ability to evaluate and make decisions about a future career path.

Exit Level Outcome 11

The qualifying *candidate* has acquired the knowledge, values and practical skills to engage in professional architectural practice in the community in a responsible, ethical manner, and in accordance with legal and statutory requirements.

Associated Assessment Criteria

The qualifying *candidate* demonstrates a working knowledge of:

- architectural practice;
- contract and environmental law;
- the roles and responsibilities of an architect in relation to building contracts;
- project management;

The qualifying *candidate* shows the ability to

- reflect upon and act in an ethical manner with communities, individuals and the environment;
- set up, organise and manage a simulated architectural practice;
- provide a competent professional service under simulated conditions.

Exit Level Outcome 12

The qualifying *candidate* will be equipped to develop entrepreneurial opportunities in a future career.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- initiative;
- independence of thought and action;
- communication and networking skills;
- an understanding of financial management and control in a professional situation.

4.1.3.3 Master of Science in Building [MSc (Building)]

Qualification Title	Master of Science in Building
Qualification Abbreviation	MSc (Building)
Minimum Period of Study	1 year full-time
NQF Exit Level	Level 9
NQF Credits	Total minimum 180

Exit Level Outcomes 1

The qualifying *candidate* demonstrates ability to work independently and shows mastery in advanced study and research methods.

Associated Assessment Criteria

The qualifying *candidate* completes a dissertation for research report that includes ability to:

- Identify and formulate a research problem;
- Perform a critical and relevant literature survey;
- Execute and critically review research using an effective methodology;
- Assess the significance of research findings;
- Write the dissertation or research report in acceptable structure, style and language.

Exit Level Outcomes 2

The qualifying *candidate* is competent to apply specialist knowledge to property finance, development, valuation and management problems.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- Both knowledge and application of knowledge in the property field;
- Competence as a property professional which includes;
- Demonstration of leadership in advanced problem-solving;
- Ability to work with others in a team;
- Showing initiative and ability to work independently with professional responsibility in the property field;
- Effective communication in any medium;
- Ability to engage in lifelong learning and to hold lifelong learning as a professional value.

Exit Level Outcomes 3

The qualifying *candidate* is competent to perform high order problem solving techniques.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- The ability to select, apply, evaluate and/or develop the most appropriate specialised approach to the solution of problems;
- An understanding of the world as a set of related systems;
- Application of diverse knowledge to development of appropriate solutions of problems, recognising wide-ranging factors including financial, environmental, health and technological aspects.

Exit Level Outcomes 4

The qualifying *candidate* will have built on his/her existing knowledge of planning, technology and management and is able to evaluate the application of planning, technology and management in relation to wider local and global environment concerns and specifically in the fields of construction, finance, planning, technology and management.

Associated Assessment Criteria

The qualifying *candidate* demonstrates ability:

- To evaluate, apply and develop existing and new planning, technological and management approaches where appropriate to the research area; to relate planning, technological and management issues within the research area to wider economic and social systems critically and ethically;
- To select, apply, evaluate and/or develop the most appropriate specialised techniques to the solution of problems.

4.1.3.4 Master of Science in Development Planning [MSc(DP)]

Qualification Title	Master of Science in Development Planning
Qualification Abbreviation	MSc(DP)
Minimum Period of Study	2 years full-time
NQF Exit Level	Level 9
NQF Credits	Total minimum 200

Exit Level Outcome 1

The *candidate* is competent to identify, evaluate and solve problems within the ambit of the field of development planning. The *candidate* is familiar with relevant theoretical paradigms, concepts and procedures.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- His/her knowledge of the historical and current theoretical planning models and approaches for industrialised and developmental contexts;
- A practical and theoretical grounding in physical planning.

Exit Level Outcome 2

The qualifying *candidate* has a knowledge of how to manage uncertainty within a changing temporal, socio-economic, political and environmental context.

Associated Assessment Criteria

The qualifying *candidate*:

- demonstrates the ability to identify and address complex problems by employing
 - appropriate planning theories,
 - concepts, and
 - quantitative or other planning techniques in dealing with them;
- demonstrates individual skills in the investigation of a specialised area of planning by defining the problem or issue, analysing it through the exploration of relevant theory, and solving it by developing a set of practical proposals;
- demonstrates familiarity with resource allocation issues and demonstrates the ability to apply project budgeting and financial viability and implementation strategies;
- can apply the concept of sustainability to socio-economic, political, cultural and legal issues affecting the physical and natural urban or rural environment.

Exit Level Outcome 3

The qualifying *candidate* is able to cope with South Africa's diverse social and cultural dynamics.

Associated Assessment Criteria

The qualifying *candidate* is competent in group work, notably with peers, and can perform:

- multi-disciplinary team work;
- field research;
- academic exercises and planning work;
- work in projects involving community participation demonstrating the skills required in dealing with the complexities of such work.

Exit Level Outcome 4

The qualifying *candidate* is able to operate independently, but within applicable professional, ethical and legal frameworks and to reflect on how this affects her/his roles as a planner. S/he has been prepared for the next stage of his/her career, whether it be professional, entrepreneurial or in some other field, and to meet the demands of continuing professional and life long development.

Associated Assessment Criteria

The qualifying *candidate*:

- understands how these facilities frameworks affect the selection and application of appropriate procedures and roles within varied contexts;
- shows skills of time management , prioritisation and initiative, in being able to perform adequately in addressing the different facets of the programme;
- has been exposed to a range of alternative career paths he or she may wish to follow, through exposure to staff, government officials, planning professionals and fellow *candidates*.

Exit level Outcome 5

The qualifying *candidate* understands planning as part of wider social, political, cultural, administrative, economic and natural systems, and their operating and financial characteristics.

Associated Assessment Criteria

The qualifying *candidate*:

- demonstrates a knowledge of the structural and operating characteristics of infra-structural and other systems and the limitations these impose on development;
- understands planning and its role in society;
- shows critical, analytical and creative thinking abilities in order to appreciate, interpret, refine apply and augment the existing body of knowledge and understanding in planning.

Exit Level Outcome 6

The qualifying *candidate* can research, analyse and interpret information in different ways and can communicate its significance to different types of audience.

Associated Assessment Criteria

The qualifying *candidate* uses:

- writing, visual, graphic, mathematical and verbal skills in thinking and communicating;
- IT (especially GIS) and manual graphics;
- in investigating and interpreting the spatial and temporal dimensions of planning and planning issues;
- demonstrates competence in qualitative and quantitative research methods and can generate, interpret and evaluate research material in the execution of a research report.

4.1.3.5 Master of Science in Quantity Surveying [MSc(QS)]

Qualification Title	Master of Science in Quantity Surveying
Qualification Abbreviation	MSc(QS)
Minimum Period of Study	1 year full-time or 2 years part-time
NQF Exit Level	Level 9
NQF Credits	Total minimum 180

Exit Level Outcome 1

The qualifying *candidate* is competent to identify, evaluate and solve problems within the ambit of the research area, and demonstrates a high level of responsibility and ethics both within the immediate context of the problem, and with regard to society as a whole. The *candidate* is familiar with relevant theoretical material for the area in which s/he is specialising.

Associated Assessment Criteria

The qualifying *candidate* demonstrates ability:

- to evaluate existing research and theory and perform individual research;
- to communicate results at an international and accepted academic level;

- to solve problems in a specific range of economic and social contexts;
- to contribute significantly to the development of society through mastery of the research area;
- to consider a range of options and make decisions about ways of seeing scientific situations and systems and their interconnectedness within broader systems.

Exit Level Outcome 2

The qualifying *candidate* is required to operate effectively in an academic environment with peers and supervisors. Where appropriate to the research area, the *candidate* is required to interact effectively with communities and other groups and individuals outside the academic arena.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- the importance of the exchange of ideas and knowledge with peers and supervisors; and is able
- to distinguish between different styles of communication in the quest for information, and can apply these appropriately and effectively;
- to apply academic ethics and responsibility to all aspects of study and research.

Exit Level Outcome 3

The qualifying *candidate* is required to have extensive communication skills and the ability to produce material of an internationally acceptable standard.

Associated Assessment Criteria

The qualifying *candidate* demonstrates

- an understanding of a range of strategies for communicating in the pursuit of data collection, and in the transmission of the results of research;
- a thorough command of communication whether written, oral, visual or using IT, and can apply these media appropriately in the presentation of research material;
- sensitivity to cultural diversity in using different modes of communicating, both in the collection of data and in presentation of the results of research.

Exit Level Outcome 4

The qualifying *candidate* will have built on his/her existing knowledge of quantity surveying and is able to evaluate the application of quantity surveying in relation to wider local and global environmental concerns and specifically in the fields of finance in construction, planning and technology.

Associated Assessment Criteria

The qualifying *candidate* demonstrates ability:

- to evaluate, apply and develop existing and new approaches where appropriate to the research area;
- to relate financial, technological and planning issues within the research area to wider economic and social systems critically and ethically;
- to respond sensitively to the choice of financial, technological and planning issues in varied cultural settings.

Exit Level Outcome 5

The *candidate* will be able to locate his/her decision making and proposals within wider procedural, social, legal, economic, intellectual and environmental contexts.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- critical awareness of his/her role as a researcher in society;
- knowledge of the legal frameworks pertaining to the research area, and is able to relate them to wider legal and ethical contexts;
- an understanding of the implications of society's expectations of research.

Exit Level Outcome 6

The qualifying *candidate* will have developed a high level of self-management with a critical awareness of personal values.

Associated Assessment Criteria

In addressing the requirements of the programme, the qualifying *candidate* demonstrates responsibility in respect of time management, self-motivation, prioritisation and initiative at an advanced level.

Exit Level Outcome 7

The qualifying *candidate* is required to have extensive skills and knowledge in the area of data collection, analysis, organisation and evaluation.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- a working knowledge of different research methods;
- an understanding of the impact of the research on society as a whole;
- ability to evaluate different methods of data manipulation within a range of scenarios, and understand the social and academic consequences of the choice of method.

Exit Level Outcome 8

The qualifying *candidate* is exposed to a range of sophisticated learning strategies, and is expected to make informed decisions on their employment. In addition, they are required to act responsibly and professionally, with full regard to the needs and aspirations of the society within which s/he operates. S/he should have considerable cultural and environmental awareness, and is required to enhance and apply this within the area of specialisation. The *candidate* is exposed to career opportunities both within an entrepreneurial and academic context.

Associated Assessment Criteria

The qualifying *candidate* is able to operate effectively in a professional and academic environment where career opportunities are open to him/her, and demonstrates:

- cultural and environmental awareness and sensitivity,
- a wide range of strategies in the pursuit of his/her studies.

4.1.3.6 Master of Science in Urban and Regional Planning [MSc(URP)]

Qualification Title	Master of Science in Urban and Regional Planning
Qualification Abbreviation	MSc(URP)
Minimum Period of Study	1 year full-time or 2 years part-time
NQF Exit Level	Level 9
NQF Credits	Total minimum 180

Exit Level Outcome 1

The qualifying *candidate* is competent to identify, evaluate and solve problems within the ambit of the research area, and demonstrates a high level of responsibility and ethics both within the immediate context of the problem, and with regard to society as a whole. In addition, s/he is familiar with relevant theoretical material for his/her area of specialisation.

Associated Assessment Criteria

The qualifying *candidate* demonstrates ability to:

- evaluate existing research and theory, and perform individual research;
- communicate results at an internationally accepted academic level;
- solve problems in a specific range of economic and social contexts;
- contribute significantly to the development of society through mastery of the research area.

Exit Level Outcome 2

The qualifying *candidate* is required to operate effectively in an academic environment with peers and supervisors. Where appropriate to the research area, the *candidate* is required to interact effectively with communities and other groups and individuals outside the academic arena.

Associated Assessment Criteria

The qualifying *candidate* demonstrates the importance of the exchange ideas and knowledge with peers and supervisors, and is able to:

- distinguish between different styles of communication in the quest for information, and can apply these appropriately and effectively;
- apply academic ethics and responsibility to all aspects of study and research.

Exit Level Outcome 3

The qualifying *candidate* is required to have extensive communication skills and the ability to produce material of an internationally acceptable standard.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- a thorough command of communication (whether written, oral, visual or using IT, and can apply these media appropriately in the presentation of research material;
- sensitivity to cultural diversity in using different modes of communicating, both in the collection of data and in presentation of the results of research.

Exit Level Outcome 4

The qualifying *candidate* will have built on his/her existing knowledge of planning technology and is able to evaluate the application of planning technology in relation to wider local and global environmental concerns.

Associated Assessment Criteria

The qualifying *candidate* demonstrates an ability to:

- evaluate, apply and develop existing and new planning approaches where appropriate to the research area;
- relate technological issues within the research area to wider economic and social systems critically and ethically;
- respond sensitively to the choice of planning technology and procedures in varied cultural settings.

Exit Level Outcome 5

The qualifying *candidate* will be able to locate his/her decision making and proposals within wider procedural and social, legal, economic, intellectual and environmental contexts.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- critical awareness of his/her role as researcher in society;
- a knowledge of the legal frameworks pertaining to the research area, and is able to relate them to wider legal and ethical contexts;
- an understanding of the implications for him/her of society's expectations of researchers.

Exit Level Outcome 6

The qualifying *candidate* will have developed a high level of self-management with a critical awareness of personal values.

Associated Assessment Criteria

The qualifying *candidate* demonstrates an understanding of time management, self-motivation, prioritisation and initiative at an advanced level, especially in respect to addressing the requirements of the programme.

Exit Level Outcome 7

The qualifying *candidate* is required to have extensive skills and knowledge in the area of data collection, analysis, organisation, interpretation and application.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- a working knowledge of different research methods;
- an understanding of the impact of research on subjects it is involved with, and on society as a whole;
- an ability to evaluate different methods of data manipulation within a range of scenarios, and understands the social and academic consequences of their choice.

Exit Level Outcome 8

The qualifying *candidate* is exposed to a range of sophisticated learning strategies, and is expected to make informed decisions on their employment. In addition, s/he is required to act responsibly and professionally, with full regard to the needs and aspirations of the society within which s/he operates.

Further, the qualifying *candidate* has considerable cultural and environmental awareness, and is required to enhance and apply this within the area of specialisation. The qualifying *candidate* is exposed to career opportunities both within an entrepreneurial and an academic context.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- cultural and aesthetic awareness and sensitivity;
- a wide range of strategies in the pursuit of his/her studies;
- an ability to operate effectively in a professional and academic environment.

4.1.3.7 Master of Urban Design [MUD]

Qualification Title	Master of Urban Design
Qualification Abbreviation	MUD
Minimum Period of Study	1½ years full-time or 3 years part-time
NQF Exit Level	Level 9
NQF Credits	Total minimum 180

Exit Level Outcome 1

The qualifying *candidate* is competent to frame, evaluate and address questions creatively and responsibly within the ambit of specialisation, and with regard to society as a whole.

Associated Assessment Criteria

The qualifying *candidate* is able to:

- frame a question and construct an argument in the field of specialisation;
- explain, apply, compare and contrast information;
- use and reorganise information.

Exit Level Outcome 2

The qualifying *candidate* is required to operate effectively both as a responsible member of a team and as a team leader. S/he is required to work collaboratively with communities and other groups, and is required to operate effectively and sensitively in such contexts.

Associated Assessment Criteria

The qualifying *candidate* is able to work in and lead a group in a range of situations, showing leadership qualities.

Exit Level Outcome 3

The qualifying *candidate* has a high level of self-management and self-motivation with a critical awareness of personal values is required in this programme.

Associated Assessment Criteria

In addressing the requirements of the programme, the qualifying *candidate* shows time management, self-motivation, prioritisation and initiative at an advanced level.

Exit Level Outcome 4

The qualifying *candidate* is required to have extensive skills and knowledge in the area of data collection, analysis, organisation and evaluation. S/he demonstrates critical, analytical thinking to interpret, extend and modify existing bodies of knowledge. S/he is able to evaluate different methods of data manipulation within a range of scenarios and understands the social and academic consequences of choice of method.

Associated Assessment Criteria

The qualifying *candidate* is able to:

- access different sources of information;
- select and organise data related to a specific discipline;
- frame a research question and select an appropriate method for research;
- act ethically in research situations.

Exit Level Outcome 5

The qualifying *candidate* is expected to have extensive communication skills in written, oral, graphic and IT media. S/he is required to extend these skills to establish authority in the field and area of specialisation.

Associated Assessment Criteria

The qualifying *candidate* demonstrates the ability to:

- convey information and interact in a range of situations using appropriate verbal and non-verbal media;
- write coherently and construct an argument following academic conventions.

Exit Level Outcome 6

The qualifying learner is required to build on his/her existing knowledge of technology to meet the demands of the area of specialisation, and to be able to make responsible choices in relation to wider local and global environmental concerns.

Associated Assessment Criteria

The qualifying *candidate* demonstrates the ability to

- evaluate, apply and develop existing and new technological approaches to the solution of problems in a wide range of contexts,
- locate technological issues within the field of specialisation to wider economic and social issues.

The *candidate* has

- a wide knowledge of the diverse use of technology related to the specialisation;
- technological competence and understanding.

The *candidate* can respond sensitively to the choice of technology in varied cultural settings.

Exit Level Outcome 7

The qualifying learner is required to locate all of his/her decision making and proposals within the wider social, legal, economic, intellectual and environmental contexts.

Associated Assessment Criteria

The qualifying *candidate* demonstrates knowledge of the legal frameworks pertaining to the area of specialisation, and is able to relate them to wider legal and ethical contexts. The *candidate* is able to solve problems in a wide range of economic and social contexts, and is able to contribute significantly to the development of society through mastery of the specialisation.

Exit Level Outcome 8

The qualifying *candidate* is exposed to a range of sophisticated learning strategies, and is expected to make informed decisions on those employed.

Associated Assessment Criteria

The qualifying *candidate* demonstrates the ability to operate effectively in a professional and academic environment. The *candidate* demonstrates mastery of a range of learning and studying approaches and a wide range of strategies in the pursuit of his/her studies.

Exit Level Outcome 9

The qualifying *candidate* is required to act responsibly as a professional, with full regard to the needs and aspirations of the society within which s/he operates.

Associated Assessment Criteria

The qualifying *candidate* demonstrates the ability to:

- work in professional teams;
- work across disciplinary boundaries; The *candidate* demonstrates an understanding of
- professional issues and the meaning of professional competence;
- the legal frameworks and their application in different contexts.

Exit Level Outcome 10

The qualifying *candidate* has considerable cultural and aesthetic awareness, and is required to enhance and apply this within the area of specialisation.

Associated Assessment Criteria

The qualifying *candidate* demonstrates cultural and aesthetic awareness and sensitivity.

Exit Level Outcome 11

The qualifying *candidate* is exposed to career opportunities both within an entrepreneurial and academic context.

Associated Assessment Criteria

The qualifying *candidate* demonstrates awareness of career opportunities open to him/her in both an academic and entrepreneurial context.

Exit Level Outcome 12

The qualifying *candidate* exhibits the capacity for critical, independent thought.

Associated Assessment Criteria

The qualifying *candidate* demonstrates the ability to think, respond and make decisions critically and analytically.

4.1.3.8 Master of the Built Environment [MBE]

Qualification Title	Master of the Built Environment
Qualification Abbreviation	MBE
Minimum Period of Study	1 years full-time
NQF Exit Level	Level 9
NQF Credits	180

Exit Level Outcome 1

The qualifying *candidate* is competent to cite and analyse theories, concepts and ideas of key local and international authors.

Associated Assessment Criteria

The qualifier is able to:

- cite and analyse key local and international theories, concepts and ideas;
- develop theoretical and conceptual frameworks and apply these to policy and practice;
- critically evaluate existing policy and develop new policy.

Exit Level Outcome 2

The qualifying *candidate* is competent to critically analyse the interaction between the housing, the social/cultural, economic and biophysical environment.

Associated Assessment Criteria

The qualifying *candidate* is able to:

- critically analyse the interaction between the housing, the social/cultural, economic and biophysical environment;
- develop approaches to enhance sustainability and mitigate negative impacts;
- to sensitively and constructively engage with local communities and service providers to identify and tackle challenges.

Exit Level Outcome 3

The qualifying *candidate* understands and is competent to analyse existing and proposed legal and financial frameworks.

Associated Assessment Criteria

The qualifying *candidate* is able to:

- analyse existing and proposed legal and financial frameworks;
- cite and analyse key positions on legal and financial aspects locally and internationally;
- apply these in judging the appropriateness of legal and financial approaches in a given context;
- develop relevant approaches.

Exit Level Outcome 4

The qualifying *candidate* is competent in advanced analysis, synthesis and application in an area of specialisation, be it socio-cultural, managerial, technical and financial. Associated Assessment Criteria

The qualifying *candidate* is able to:

- engage with complex challenges and identify and solve complex problems by developing theoretically grounded and reflected approaches.

Exit Level Outcome 5

The qualifying *candidate* has extensive skills and knowledge in the area of data collection, analysis, organisation and evaluation. S/he demonstrates critical analytical thinking to interpret, extend and modify existing bodies of knowledge. S/he is able to evaluate different methods of data manipulation within a range of scenarios, and understands the social and academic consequences of choice of method.

Associated Assessment Criteria

The qualifying *candidate* is able to:

- access different sources of information;
- select and organise data related to a specific discipline;
- frame a research question and select an appropriate method for research;
- act ethically in research situations.

4.1.4 Doctoral Degrees

4.1.4.1 Doctor of Philosophy [PhD]

Qualification Title	Doctor of Philosophy
Qualification Abbreviation	PhD
Minimum Period of Study	2 years full-time or 4 years part-time
NQF Exit Level	Level 10
NQF Credits	Total minimum 360

Exit Level Outcome 1

The qualifying *candidate* is capable of independent and original research.

Associated Assessment Criteria

The qualifying *candidate* completes a thesis by

- identifying and formulating a research problem;
- performing a critical and relevant literature survey;
- executing, critically reviewing and iterating research using appropriate methodologies and techniques;
- assessing the significance of research findings, making the case for original contribution and placing the work in the context of the discipline and wider issues where relevant;
- producing the thesis or compilation of publishable work in acceptable structure, style and language.

Exit Level Outcome 2

The qualifying *candidate* possesses highly specialised, authoritative knowledge and is competent to apply that knowledge to the solution of problems.

Associated Assessment Criteria

The qualifying *candidate* demonstrates highly specialised, authoritative knowledge, and application and development of that expert knowledge, in a specialised field, which could include:

- an expert understanding of the content of the chosen topic of study, with understanding of the context, i.e. of the world as a set of related systems;
- the ability to work, independently or in a team, to select, apply, evaluate and/or develop the most appropriate approach to the solution of problems, recognising wide-ranging factors which could include financial, environmental, social, cultural, health and technological aspects.

Exit Level Outcome 3

The qualifying *candidate* is self-directed and self-critical.

Associated Assessment Criteria

The qualifying *candidate* demonstrates awareness of the need to be able to:

- independently plan, co-ordinate and review research work, usually under supervision;
- show initiative, and to manage himself/herself in an effective and responsible manner;
- be culturally and aesthetically sensitive;
- communicate in appropriate media;
- practise lifelong learning.

4.1.5 Senior Doctoral Degrees

4.1.5.1 Doctor of Architecture [DArch]

Qualification Title	Doctor of Architecture
Qualification Abbreviation	DArch
Minimum Period of Study	n/a (published work)
NQF Exit Level	Level 10
NQF Credits	360

Exit Level Outcomes

- The qualifying *candidate* demonstrates, through the cumulative impact of original work of publishable standard, a distinguished contribution to knowledge.
- The qualifying *candidate* demonstrates an understanding, with a high degree of sophistication, of the construction of knowledge within the field and applies that understanding to knowledge creation and/or application.

Associated Assessment Criterion

The qualifying *candidate* has produced a substantial and co-ordinated body of distinguished original work, of publishable standard, for assessment.

4.1.5.2 Doctor of Town and Regional Planning [D(TRP)]

Qualification Title	Doctor of Town and Regional Planning
Qualification Abbreviation	D(TRP)
Minimum Period of Study	n/a (published work)
NQF Exit Level	Level 10
NQF Credits	360

Exit Level Outcomes

- The qualifying *candidate* demonstrates, through the cumulative impact of original work of publishable standard, a distinguished contribution to knowledge.
- The qualifying *candidate* demonstrates an understanding, with a high degree of sophistication, of the construction of knowledge within the field and applies that understanding to knowledge creation and/or application.

Associated Assessment Criterion

The qualifying *candidate* has produced a substantial and co-ordinated body of distinguished original work, of publishable standard, for assessment.

4.1.5.3 Doctor of Science in Architecture [DSc(Arch)]

Qualification Title	Doctor of Science in Architecture
Qualification Abbreviation	DSc(Arch)
Minimum Period of Study	n/a (published work)
NQF Exit Level	Level 10
NQF Credits	360

Exit Level Outcomes

- The qualifying *candidate* demonstrates, through the cumulative impact of original work of publishable standard, a distinguished contribution to knowledge.
- The qualifying *candidate* demonstrates an understanding, with a high degree of sophistication, of the construction of knowledge within the field and applies that understanding to knowledge creation and/or application.

Associated Assessment Criterion

The qualifying *candidate* has produced a substantial and co-ordinated body of distinguished original work, of publishable standard, for assessment.

4.1.5.4 Doctor of Science in Building [DSc(Building)]

Qualification Title	Doctor of Science in Building
Qualification Abbreviation	DSc(Building)
Minimum Period of Study	n/a (published work)
NQF Exit Level	Level 10
NQF Credits	360

Exit Level Outcomes

- The qualifying *candidate* demonstrates, through the cumulative impact of original work of publishable standard, a distinguished contribution to knowledge.
- The qualifying *candidate* demonstrates an understanding, with a high degree of sophistication, of the construction of knowledge within the field and applies that understanding to knowledge creation and/or application.

Associated Assessment Criterion

The qualifying *candidate* has produced a substantial and co-ordinated body of distinguished original work, of publishable standard, for assessment.

4.1.5.5 Doctor of Science in Quantity Surveying [DSc(QS)]

Qualification Title	Doctor of Science in Quantity Surveying
Qualification Abbreviation	DSc(QS)
Minimum Period of Study	n/a (published work)
NQF Exit Level	Level 10
NQF Credits	360

Exit Level Outcomes

- The qualifying *candidate* demonstrates, through the cumulative impact of original work of publishable standard, a distinguished contribution to knowledge.
- The qualifying *candidate* demonstrates an understanding, with a high degree of sophistication, of the construction of knowledge within the field and applies that understanding to knowledge creation and/or application.

Associated Assessment Criterion

The qualifying *candidate* has produced a substantial and co-ordinated body of distinguished original work, of publishable standard, for assessment.

4.1.6 Diplomas

4.1.6.1 Postgraduate Diploma in Property Development and Management [PGDip. (Property Development & Management)]

Qualification Title	Postgraduate Diploma in Property Development and Management
Qualification Abbreviation	PGDip (Property Development & Management)
Minimum Period of Study	1 year full-time / 2 years part-time
NQF Exit Level	Level 8
NQF Credits	Total minimum 120

Exit Level Outcome 1

The qualifying *candidate* demonstrates ability to work independently and shows mastery in advanced study and research methods.

Associated Assessment Criteria

The qualifying *candidate* completes a dissertation for research report that includes ability to:

- Identify and formulate a research problem
- Perform a critical and relevant literature survey
- Execute and critically review research using an effective methodology
- Assess the significance of research findings
- Write the dissertation or research report in acceptable structure, style and language.

Exit Level Outcome 2

The qualifying is competent to apply specialist knowledge to property finance, development, valuation and management problems.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- Both knowledge and application of knowledge in the property field;
- Competence as a property professional which includes;
- Demonstration of leadership in advanced problem-solving;
- Ability to work with others in a team;
- Showing initiative and ability to work independently with professional responsibility in the property field;
- Effective communication in any medium;
- Ability to engage in lifelong learning and to hold lifelong learning as a professional value.

Exit Level Outcome 3

The qualifying *candidate* is competent to perform high order problem solving techniques.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- The ability to select, apply, evaluate and/or develop the most appropriate specialised approach to the solution of problems;
- An understanding of the world as a set of related systems;
- Application of diverse knowledge to development of appropriate solutions of problems, recognising wide-ranging factors including financial, environmental, health and technological aspects.

Exit Level Outcome 4

The qualifying *candidate* will have built on his/her existing knowledge of planning, technology and management and is able to evaluate the application of planning, technology and management in relation to wider local and global environment concerns and specifically in the fields of construction, finance, planning, technology and management.

Associated Assessment Criteria

The qualifying *candidate* demonstrates ability:

- To evaluate, apply and develop existing and new planning, technological and management approaches where appropriate to the research area; to relate planning, technological and management issues within the research area to wider economic and social systems critically and ethically;
- To select, apply, evaluate and/or develop the most appropriate specialised techniques to the solution of problems.

4.2 Engineering

4.2.1 Degrees of Bachelor

4.2.1.1 Bachelor of Engineering Science in Biomedical Engineering [BEngSc(BME)]

Qualification Title	Bachelor of Engineering Science in Biomedical Engineering
Qualification Abbreviation	BEngSc(BME)
Minimum Period of Study	3 years full-time
NQF Exit Level	Level 7
NQF Credits	Total minimum 360

Exit Level Outcome 1

The *student* will have developed a comprehensive understanding of living systems.

Associated Assessment Criteria

- Will understand the genetic and molecular basis of life;
- Will understand the interaction of living systems with each other.

Exit Level Outcome 2

The *student* will be able to use basic knowledge of living systems to appreciate the complexities and ethical considerations in medical research.

Associated Assessment Criteria

- Understand the principles of the latest technologies including cloning, cell biology and cancer treatment;
- Will understand and appreciate the ethical dilemmas associated with new technologies.

Exit Level Outcome 3

The *student* will have developed a thorough understanding of engineering science and its wide applicability.

Associated Assessment Criteria

- Ability to solve engineering problems and perform quantitative analysis;
- Gain insight into uncertainty in science and its effect on understanding;
- Ability to apply engineering sciences to diverse fields such as biology and medicine.

Exit Level Outcome 4

The *student* will develop the skill to communicate technical ideas effectively.

Associated Assessment Criteria

- Will be able to do verbal presentations on complex technical subjects;
- Will be required to present written communications including research reports and problem solving

Exit Level Outcome 5

The *student* will develop the skill to make rapid quantitative estimates.

Associated Assessment Criterion

Uses sound engineering judgement and learns to estimate the magnitude of answers prior to calculating.

Exit Level Outcome 6

The *student* is able to integrate life sciences and engineering sciences and to appreciate the principles common to both disciplines.

Associated Assessment Criteria

- Appreciates systems theory and its applicability across a range of subjects;
- Appreciates the way in which many engineering processes have analogues in the living world.

Exit level outcome 7

The *student* is able to appreciate the social implications of health and engineering in the context of South Africa's socio-economic environment.

Associated Assessment Criteria

- Understands the critical importance of budgetary constraints on health care delivery;
- Is able to make a useful assessment of the cost-benefit ratio of advanced technologies.

Exit Level Outcome 8

The *student* works well in a multi-disciplinary team environment and to appreciate the value of diversity in skills.

Associated Assessment Criteria

Demonstrates an ability to work in a team environment with engineers, physicists, chemists, doctors and other professionals.

Exit Level Outcome 9

The *student* understands the importance of clear communication with peers and colleagues, as well as the requirement to assume responsibility and managing uncertainty.

Associated Assessment Criteria

- Demonstrate an awareness of how poor or vague communication can lead to undesirable or tragic outcomes;
- Demonstrates an understanding of the importance of making decisions and taking responsibility;
- Demonstrates an awareness of the requirement to sometimes make rapid decisions in the absence of complete information in an attempt to optimise the probability of a favourable outcome.

Exit Level Outcome 10

Is experienced in deriving knowledge from a wide range of learning environments.

Associated Assessment Criteria

Demonstrates and ability to learn from a wide range of teaching and study environments such as: seminars and presentations, small group study, independent study and formal lectures.

Exit Level Outcome 11

Student understands the effect of her/his discipline on other areas of society.

Associated Assessment Criterion

Appreciates the beneficial effect of good health care on social and environmental well being.

4.2.1.2 Bachelor of Science in Engineering [BSc(Eng)]

Qualification Title	Bachelor of Science in Engineering
Qualification Abbreviation	BSc(Eng)
Minimum Period of Study	4 years full-time
NQF Exit Level	Level 8
NQF Credits	Total minimum 480

1. Engineering competence

Exit Level Outcome

The qualifying *student* is competent to:

- identify, assess and solve open-ended engineering problems creatively and innovatively;
- apply knowledge of mathematics, basic science and engineering sciences from first principles to solve engineering problems;
- design components, systems and processes while dealing with constraints, assessing financial and social costs and benefits, and taking other impacts into account;
- plan and conduct investigations and experiments;
- analyse and interpret data and derive information from data;
- exercise limited engineering judgement;
- use modern engineering methods, skills and tools to assess their outputs;
- communicate effectively in writing and orally with supervisors, peers and subordinates;
- recognise the impact of engineering activity on society and the environment;
- function in a multidisciplinary team environment;
- appreciate the value of working effectively and efficiently;
- be aware of the importance of engaging in lifelong learning and holding lifelong learning as a professional value;
- recognise the need to act professionally and ethically within their own area of competence.

Associated Assessment Criteria

The qualifying *student* demonstrates ability to:

- complete at all levels of study, individually and as a member of a team of *students*, written reports which detail a design or the outcomes of an investigation;
- complete laboratory research reports and design project reports in acceptable style, language and presentation;
- plan, execute and report on vacation work where appropriate.

The qualifying *student* meets the minimum requirements in six defined knowledge areas:

2. Mathematics

Exit Level Outcomes

The qualifying *student* is competent to bring mathematical, numerical analysis and statistical knowledge and methods to bear on engineering problems.

Associated Assessment Criteria

The qualifying *student* will demonstrate this ability by using an appropriate mix of:

- formal analysis and modelling of engineering components, systems or processes;
- communicating concepts, ideas and theories with the aid of mathematics;
- reasoning about and conceptualising engineering components, systems or processes using mathematical concepts;
- dealing with uncertainty through the use of probability and statistics.

3. Basic Sciences

Exit Level Outcome

The qualifying *student* is competent to use physical laws and knowledge of the physical world as a foundation for the engineering sciences and the solution of engineering problems.

Associated Assessment Criteria

The qualifying *student* will demonstrate this ability by using an appropriate mix of:

- formal analysis and modelling of engineering components, systems or processes using principles and knowledge of the basic sciences;
- reasoning about and conceptualising engineering problems, components, systems or processes using principles of the basic sciences.

4. Engineering Sciences

Exit Level Outcome

The qualifying *student* is competent in defined areas of engineering science to use the techniques, principles and laws of engineering science.

Associated Assessment Criteria

The qualifying *student* shall demonstrate the ability to:

- identify and solve open-ended engineering problems;
- create engineering applications within the scope of the course;
- work across engineering disciplinary boundaries through cross disciplinary literacy and shared fundamental knowledge which a *student* may demonstrate in specific cases.

5. Engineering Design and Synthesis

Exit Level Outcome

The qualifying *student* is competent to perform creative, non-procedural design and synthesis of components, system, products or processes to meet user needs, applicable standards, codes of practice and legislation.

Associated Assessment Criteria

The qualifying *student* will demonstrate this ability by:

- recognising and formulating the design problem;
- recognising the applicable principles;
- planning and managing the design process, focusing on important issues;
- recognising and dealing with constraints;
- acquiring, extending and evaluating the requisite knowledge and information;
- applying, integrating, transferring and synthesising knowledge and information;
- performing design tasks including quantitative modelling and optimisation;
- evaluating and using design tools;
- evaluating alternatives and chosen solution, exercising judgement and testing implementability;
- performing techno-economic analyses;

- taking the wider impact of the design into account involving legal, health, safety, environmental, social, and political factors;
- communicating the design logic and information.

6. Computing and Information Technology

Exit Level Outcome

The qualifying *student* is competent to use appropriate computing and information technology applications.

Associated Assessment Criteria

The qualifying *student* is competent to:

- use computer packages for computation, modelling, simulation, and information handling, involving;
- assessment of the applicability and limitations of the package;
- proper application and operation of the package;
- critical testing and assessment of the end-results produced by the package;
- use computers and networks for accessing, processing, managing, and storing information to
- enhance personal productivity and teamwork;
- create computer applications as required by the discipline.

7. Complementary Studies

Exit Level Outcome

The qualifying *student* recognises the impact of engineering activity on society and the environment and is able to communicate effectively in writing and orally with supervisors, peers and subordinates.

Associated Assessment Criteria

The qualifying *student* shows:

- competence to communicate effectively orally and in writing with both engineering and other audiences, using appropriate structure, style and graphical support;
- ability to bring basic techniques and knowledge to bear on engineering practice from economics, business management, health, safety, environment;
- awareness of and can bring into engineering analysis and design of:
 - the impact of technology on society,
 - the personal, social, cultural values and requirements of those affected by engineering activity;
- professional ethics.

4.2.2 Degrees of Master

4.2.2.1 Master of Engineering (Professional) [MEng (Prof)]

Qualification Title	Master of Engineering(Professional)
Qualification Abbreviation	MEng (Prof)
Minimum Period of Study	1 year full-time or 2 years part-time
NQF Exit Level	9
NQF Credits	Total minimum 180

1. Specialist knowledge

Exit Level Outcome

The qualifying *candidate* is competent to apply specialist knowledge to engineering problems.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- both knowledge and application of that knowledge in a specialised field;
- competence as an engineer which includes;
- demonstration of leadership in advanced problem-solving;
- ability to work with others in a team;
- showing initiative and ability to work independently with professional responsibility in a specialised field;
- effective communication in any medium;
- ability to engage in lifelong learning and to hold lifelong learning as a professional value.

2. High order problem-solving**Exit Level Outcome**

The qualifying *candidate* is competent to perform high order problem solving techniques.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- the ability to select, apply, evaluate and/or develop the most appropriate specialised approach to the solution of problems;
- an understanding of the world as a set of related systems and can integrate knowledge across the various fields of engineering;
- application of diverse knowledge to development of appropriate solutions of problems, recognising wide-ranging factors including management, financial, environmental, health and technological aspects.

3. Tools and Techniques**Exit Level Outcome**

The qualifying *candidate* is competent to apply specialised engineering tools and techniques.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- the ability to select, apply, evaluate and/or develop the most appropriate specialised techniques to the solution of problems;
- use of specialist engineering tools and techniques effectively and critically.

4.2.2.2 Master of Science in Engineering [MSc(Eng)]**1. Research mastery****Exit Level Outcome**

The qualifying *candidate* demonstrates ability to work independently and shows mastery in advanced study and research methods.

Associated Assessment Criteria

The qualifying *candidate* completes a dissertation or research report which includes ability to:

- identify and formulate a research problem;
- perform a critical and relevant literature survey;
- execute and critically review research using an effective methodology;
- assess the significance of research findings;
- write the dissertation or research report in acceptable structure, style and language.

2. Specialist knowledge

Exit Level Outcome

The qualifying *candidate* is competent to apply specialist knowledge to engineering problems.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- both knowledge and application of that knowledge in a specialised field;
- competence as an engineer which includes;
- demonstration of leadership in advanced problem-solving;
- ability to work with others in a team;
- showing initiative and ability to work independently with professional responsibility in a specialised field;
- effective communication in any medium;
- ability to engage in lifelong learning and to hold lifelong learning as a professional value.

3. High order problem-solving

Exit Level Outcome

The qualifying *candidate* is competent to perform high order problem solving techniques

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- the ability to select, apply, evaluate and/or develop the most appropriate specialised approach to the solution of problems;
- an understanding of the world as a set of related systems;
- application of diverse knowledge to development of appropriate solutions of problems, recognising wide-ranging factors including financial, environmental, health and technological aspects.

4. Tools and techniques

Exit Level Outcome

The qualifying *candidate* is competent to apply specialised engineering tools and techniques.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- the ability to select, apply, evaluate and/or develop the most appropriate specialised techniques to the solution of problems;
- use of specialist engineering tools and techniques effectively and critically.

4.2.2.3 Master of Nuclear Technology Leadership [M NTL]

Qualification Title:	Master of Nuclear Technology Leadership [M NTL]
Qualification Abbreviation:	M NTL
Minimum Period of Study:	1 year full-time or 2 years part-time
NQF Exit Level:	Level 9
NQF Credits:	Total minimum 180

Exit Level Outcome

- The qualifying *candidate* is competent to apply specialist knowledge to engineering problems.
- The qualifying *candidate* is competent to perform high order problem solving techniques.

- The qualifying *candidate* is competent to apply specialised engineering tools and techniques.
- The qualifying *candidate* demonstrates a critical awareness of the impact of engineering activities on the social, industrial and physical environments.

Associated Assessment Criteria

- Students will be assessed against the competencies expected at NQF level 9 in the area of Nuclear Technology Leadership as follows:
- A comprehensive, systematic and integrated knowledge of all the relevant disciplines, with specialist knowledge at the forefront of professional practice.
- A coherent and critical understanding of the theories, research methodologies, epistemologies, and methods/techniques relevant to the individual disciplines and the area of practice as a whole.
- The ability rigorously to critique and evaluate current research in the area and participate in scholarly debates; to relate theory and practice and vice versa; familiarity with the application of relevant research methodologies, methods/techniques and technologies.
- The ability to use a range of specialised skills to identify, analyse and deal with complex problems and issues drawing systematically and creatively on the theories, research methodologies, methods/techniques, literature and materials of the disciplines contained in the field.
- The ability to demonstrate advanced information retrieval and processing skills to identify, analyse, synthesise and independently evaluate quantitative and/or qualitative data, using appropriate ICT.
- The ability to plan, execute and write up a research, investigation in an area of specialisation, under supervision.
- The ability to effectively present and communicate the results of research to specialist and non-specialist audiences, using the resources of academic/professional discourse, and the production of a research report which meets the standards of scholarly/ professional writing/ presentation.
- Students will be expected to demonstrate the above competencies through a judicious combination of group project work, individual project work and individual examinations. In addition, the capstone research project will be assessed on the basis of written technical and reporting abilities.

4.2.3 Doctoral Degree

4.2.3.1 Doctor of Philosophy [PhD]

Qualification Title	Doctor of Philosophy
Qualification Abbreviation	PhD
Minimum Period of Study	2 years full-time or 4 years part-time
NQF Exit Level	Level 10
NQF Credits	Total minimum 360

Exit Level Outcome 1

The qualifying *candidate* is capable of independent and original research.

Associated Assessment Criteria

The qualifying *candidate* completes a thesis by:

- identifying and formulating a research problem;
- performing a critical and relevant literature survey;
- executing, critically reviewing and iterating research using appropriate methodologies and techniques;
- assessing the significance of research findings, making the case for original contribution and
- placing the work in the context of the discipline and wider issues where relevant;

- producing the thesis or compilation of publishable work in acceptable structure, style and language.

Exit Level Outcome 2

The qualifying *candidate* possesses highly specialised, authoritative knowledge and is competent to apply that knowledge to the solution of problems.

Associated Assessment Criteria

The qualifying *candidate* demonstrates highly specialised, authoritative knowledge, and application and development of that expert knowledge, in a specialised field, which could include;

- an expert understanding of the content of the chosen topic of study, with understanding of the context, i.e. of the world as a set of related systems;
- the ability to work, independently or in a team, to select, apply, evaluate and/or develop the most appropriate approach to the solution of problems, recognising wide-ranging factors which could include financial, environmental, social, cultural, health and technological aspects.

Exit Level Outcome 3

The qualifying *candidate* is self-directed and self-critical.

Associated Assessment Criteria

The qualifying *candidate* demonstrates awareness of the need to be able to:

- independently plan, co-ordinate and review research work, usually under supervision;
- show initiative, and to manage himself / herself in an effective and responsible manner;
- be culturally and aesthetically sensitive;
- communicate in appropriate media;
- practise lifelong learning.

4.2.4 Senior Doctoral degrees

4.2.4.1 Doctor of Engineering [DEng]

Qualification Title	Doctor of Engineering
Qualification Abbreviation	DEng
Minimum Period of Study	n/a (published work)
NQF Exit Level	Level 10
NQF Credits	360

Exit Level Outcomes

Candidates are required to be able to:

- access and process information responsibly using a range of technologies;
- communicate and produce information responsibly using a range of technologies;
- critically analyse and problem solve;
- demonstrate a thorough knowledge of methods and relevant literature appropriate to engineering development and a mastery of relevant techniques;
- contribute substantial and original work in the field of engineering;
- show understanding of their ethical obligations;
- assess the significance of the developments and their application in engineering practice;
- demonstrate his/her authority in the chosen field of engineering development.

Associated Assessment Criteria

The applicant demonstrates, through a coordinated compendium of original, published work (or work accepted for publication) submitted for examination, a distinguished contribution to the practice of engineering; the work must be a record of engineering development of major, technological, economic or social significance carried out under the technical direction of the *candidate*.

4.2.4.2 Doctor of Science in Engineering [DSc(Eng)]

Qualification Title	Doctor of Science in Engineering
Qualification Abbreviation	DSc(Eng)
Minimum Period of Study	n/a (published work)
NQF Exit Level	Level 9
NQF Credits	360

Exit Level Outcomes

Candidates are required to be able to:

- access and process information responsibly using a range of technologies;
- communicate and produce information responsibly using a range of technologies;
- critically analyse and problem solve;
- demonstrate a thorough knowledge of methods and relevant literature appropriate to research and a mastery of relevant techniques;
- contribute substantial and original work to the international body of knowledge in their field;
- show understanding of their ethical obligations;
- assess the significance of their work;
- demonstrate his/her authority in the chosen field of research.

Associated Assessment Criteria

The applicant demonstrates, through a coordinated compendium of original, published work (or work accepted for publication) submitted for examination, a distinguished contribution to the international research; the work must be a record of engineering development of major, technological, economic or social significance carried out under the technical direction of the *candidate*.

4.2.5 Diplomas**4.2.5.1 Postgraduate Diploma in Engineering [PGDip(Engineering)]**

Qualification Title	Postgraduate Diploma in Engineering
Qualification Abbreviation	PGDip(Engineering)
Minimum Period of Study	1 year full-time or 2 years part-time
NQF Exit Level	Level 8
NQF Credits	Total minimum 120

1. Specialist knowledge**Exit Level Outcome**

The qualifying *candidate* is competent to apply specialist knowledge to engineering problems.

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- both knowledge and application of that knowledge in a specialised field;

- competence as an engineer which includes;
- ability to work with others in a team;
- showing initiative and ability to work independently with professional responsibility in a specialised field;
- effective communication in any medium;
- ability to engage in lifelong learning and to hold lifelong learning as a professional value.

2. High order problem solving

Exit Level Outcome

The qualifying *candidate* is competent to perform high order problem solving techniques

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- the ability to select, apply, evaluate and/or develop the most appropriate specialised approach to the solution of problems;
- an understanding of the world as a set of related systems;
- application of diverse knowledge to development of appropriate solutions of problems, recognising wide-ranging factors including financial, environmental, health and technological aspects.

3. Specialised engineering tools and techniques

Exit Level Outcome

The qualifying *candidate* is competent to apply specialised engineering tools and techniques

Associated Assessment Criteria

The qualifying *candidate* demonstrates:

- the ability to select, apply, evaluate and/or develop the most appropriate specialised
- techniques to the solution of problems;
- use of specialist engineering tools and techniques effectively and critically.

SYLLABUSES FOR THE FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

The order of the courses is based on the following scheme:

- In alphabetical order by school offering the course.
- In alphabetical order within schools by course code.

The code before each course name is the course code. Where numbers appear in parentheses after a course name they refer to the credit points, course contact time in 45 minute periods per week, (lectures-tutorials-laboratory) and duration of course.

Courses in other faculties

The syllabuses for optional courses offered in the Faculty which are not contained in this booklet will be found in either, the rules and syllabus booklets for Humanities, Science or Commerce, Law & Management which may be consulted in the Faculty Office.

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

Course Code: FEBE1000A/FEBE1001A (PT)

Course Description: Introduction to the Engineering Profession

NQF Credits: 12

NQF Level: 5

This course introduces students to the various engineering disciplines, engineering materials, the social and environmental context of engineering, engineering communication and vocabulary, non-technical problem solving and critical thinking.

Course Code: FEBE1002A/FEBE1003A (PT)

Course Description: Engineering Analysis and Design IA

NQF Credits: 12

NQF Level: 5

This course covers graphic representation including freehand drawing, descriptive geometry and computer aided design (CAD), creation and interpretation of engineering technical drawings. The student is introduced to solving problems and creating engineering artefacts through the use of the engineering method, unit conversions, financial appraisal and basic computer software including word processing and spreadsheets in order to produce reports of engineering designs.

Course Code: FEBE1004A/FEBE1005A (PT)

Course Description: Engineering Analysis and Design IB

NQF Credits: 12

NQF Level: 5

This course introduces students to the production of simple engineering designs to appropriate engineering practice standards. The course covers the application of basic engineering science in the design of artefacts and working principles of common engineering products. Students are required to master technical report writing.

SCHOOL OF ANATOMICAL SCIENCES**Course Code: ANAT2020A****Course Description: Human Anatomy****NQF Credits: 48****NQF Level: 7**

This course provides topics in:

Morphological anatomy:

Practical dissections, lectures and tutorials will be used to study the human body. Tutorials and problem solving exercises will include aspects of osteology, developmental anatomy and radiological anatomy. Histology and Embryology:

The light and electron microscope study of cells, tissue systems and organ systems in man will be covered in lectures, tutorials, problem-solving exercises and practical sessions. The development of man from fertilisation to birth, including congenital malformations, will be dealt with in lectures and tutorials. Integration of morphological anatomy, developmental anatomy and histology is a major aim of this course.

SCHOOL OF ANIMAL, PLANT AND ENVIRONMENTAL SCIENCES**Course Code: APES1002A****Course Description: Introductory Physiology and Environmental Sciences I****NQF Credits: 18****NQF Level: 5**

This course has two components:

- 1) a review of the relationship between the structure and function of the circulatory, respiratory, ventilation, nervous and endocrine systems, as well as muscle structure and function and temperature control in various vertebrates. Homeostasis is the theme that links all these systems together.
- 2) aspects of ecology and the impact of humans on the environment

SCHOOL OF ARCHITECTURE AND PLANNING**Course Code: ARPL1000A****Course Description: Architectural Design and Theory I****NQF Credits: 60****NQF Level: 5**

This course is an introduction to design theory and lays the foundation of architectural thinking by presenting conceptual design principles, architectural elements, contextual influences, basic space-making and collaborative engagement. Emphasis is placed on the development of design processes and methods of production to explore architectural possibilities.

Course Code: ARPL1001A**Course Description: Theory and Practice of Construction I****NQF Credits: 30****NQF Level: 5**

This course provides an introduction to basic building technology, materials and National Building Regulations, roles and responsibilities of architects, technical drawing, the building processes in domestic contexts, elementary services of water supply, sewerage reticulation and electrical supply, an introduction to topography, basic survey techniques and soil conditions and services related to specific soil conditions.

Course Code: ARPL1010A**Course Description: Planning for Property Developers****NQF Credits: 18****NQF Level: 5**

This course introduces theories of planning and the planning process, the relationship between planning and the property market, planning law and systems of planning in South Africa that impact on property environmental impact assessments, spatial development frameworks, local economic development, inner-city regeneration, urban decentralisation and edge city development.

Course Code: ARPL1014A**Course Description: Settlements through History****NQF Credits: 12****NQF Level: 5**

The course introduces the evolution of human settlement through history around the world and presents human settlements as ever-changing cultural constructs that are always open to new interpretation and understanding. The course includes an African perspective on settlement by specifically focusing on Southern Africa and tracing the many forces that have shaped and are currently shaping cities develops students' theoretical skills and writing ability.

Course Code: ARPL1015A**Course Description: Introduction to Environmental Interpretation****NQF Credits: 24****NQF Level: 5**

This course directs the attention of students to their living environments, and to the physical, cultural, social, political and economic factors that are shaping the nature of these environments. The course introduces the student to different living environments shaped within different cultural contexts. The course introduces students to graphic and other visual skills that are used in interpreting settlements and presenting plans.

Course Code: ARPL1016A**Course Description: Introduction to Settlement Form and Design****NQF Credits: 24****NQF Level: 5**

This course introduces different types of settlements in urban and rural areas, the shape (or morphology) of these settlements, the idea of urban environmental design, the various elements that comprise a settlement, the different urban components and basic design elements with a focus on the development of graphic communication and the application of digital technologies

Course Code: ARPL1025A**Course Description: Two and Three Dimensional Computer Aided Design and GIS****NQF Credits: 12****NQF Level: 6**

This course introduces Computer Aided Design (CAD) and Geographic Information System (GIS). Students are required to use these tools, techniques and technologies for practical application in their courses and projects.

Course Code: ARPL1026A**Course Description: Identity and Society I****NQF Credits: 18****NQF Level: 5**

This course is an introduction to the theoretical and conceptual foundations of Sociology. It locates the discipline's key concerns with the relationship between individuals and the social context, and examines sociological debates around modernity, social change and identity. This will be achieved by an in-depth exploration of the ideas of central classical theorists. The course also aims to develop students' content knowledge, and reading and writing skills.

Course Code: ARPL1031A**Course Description: Histories and Theories of Architecture I****NQF Credits: 8****NQF Level: 5**

This course explores the foundations of spatial culture as found in human habitation before 'settlement' and the nature of early settlements, landscapes and ritual spaces.

Course Code: ARPL1028A**Course Description: Design Representation I****NQF Credits: 10****NQF Level: 5**

This course introduces forms of design and architectural representation and production. Through measured, free-hand, and creative forms of visual representation, the course introduces the fundamentals of descriptive geometry, three-dimensional representation drawings, principles of perspective drawing, and various methods of producing illustrative and rendered means of visual representation.

Course Code: ARPL1029A**Course Description: Digital Applications in Architecture 1****NQF Credits: 10****NQF Level: 5**

This course introduces digital architectural production and uses contemporary industry-relevant software in the architectural discipline as tools for both architectural design and representation.

Course Code: ARPL1030A**Course Description: Building Ecology****NQF Credits: 7****NQF Level: 5**

This course introduces the theoretical underpinnings of and design approaches to the harmonious and interdependent relationship of the natural and built environment. It explores the interconnectedness of design and socio-ecological systems and critically examines the influences and effects of various scales of planning, design and building on approaches to sustainability.

Course Code: ARPL1032A**Course Description: History of Settlement and Architecture****NQF Credits: 12****NQF Level: 5**

This course explores settlements and architectural productions in Africa and in other parts of the world. A selection of settlements, architectural design, art objects, and spatial ensembles from different periods of time in Africa, Asia, Europe, and Latin America are used to show that urban and regional planning and architectural programmes are continuously evolving along with human experiences in temporal and in physical spaces.

Course Code: ARPL2000A**Course Description: Architectural Design and Theory II****NQF Credits: 60****NQF Level: 6**

This course explores the development of sustainable architectural approaches in myriad contexts through an integrated presentation of theory, practical analyses and creative design processes. Topics include theory of place-making and the role of ecological, cultural and socio-economic considerations form core tenets of design and analysis projects developed in response to natural systems, urban influences, topography, and the integration of building and landscape across small-scale, mixed-use and multi-unit housing buildings.

Course Code: ARPL2002A**Course Description: Theory and Practice of Construction II****NQF Credits: 30****NQF Level: 6**

This course introduces framed structures (timber, steel and concrete), cladding systems, services related to framed structures and relevant National Building Regulations. It has three components: building climate focuses on thermal concepts and principles; passive and active energy system; use of solar charts and shading diagrams and an introduction to a range of building materials and structural systems; services focuses on plumbing, fire and electrical reticulation; and relevant national building regulations: focussing on the development and the preparation of technical documentation.

Course Code: ARPL2006A**Course Description: Planning for Housing, Services, Infrastructure and Transport****NQF Credits: 12****NQF Level: 6**

This course introduces topics in relation to both rural and urban areas: national and provincial policies in relation to the above; service delivery options; financing and institutional arrangements (e.g. public-private partnerships and municipal service delivery agreements); the contribution of services and infrastructure to local economic development; inter-sectoral co-ordination; concepts such as corridors, nodes, densification; and basic principles of project management and urban land economics.

Course Code: ARPL2012A**Course Description: Histories and Theories of Architecture II****NQF Credits: 20****NQF Level: 6**

This course explores architecture and its codification until the roots of modernism. The architecture of dynastic, religious and imperial centres of power in relation to technological developments, new materials, religious and aesthetic ideals are examined and the course has four distinct periods in the history and theory of architecture

Course Code: ARPL2013A**Course Description: Introduction to Land Management****NQF Credits: 18****NQF Level: 6**

The course introduces land management. It incorporates different forms of land legal issues (cadastre, general plan, deeds registry, boundaries, rights etc.); land uses (categories, relationships between uses, thresholds etc.); land use management (zonings, schemes etc.); different approaches to land use regulation; and, technologies used in the management of land - including Geographical Information Systems (GIS), satellite-linked survey systems, aerial photos and remote sensing; relationships between land use, densities, services and transport. The course also introduces the challenges and critiques of formal property ownership; rights of users of land vs owners, land uses and transactions outside of and unrecognized by the formal system. The dynamics underlying informal land processes, their implications and management challenges are considered. The course explores the consequences and implications of alternative practices in recent urban land management studies.

Course Code: ARPL2015A**Course Description: Contemporary Design and Environmental Issues in South Africa****NQF Credits: 18****NQF Level: 6**

This course focuses on concepts of liveability and environmental quality; the public realm and privatisation of space; inner-city redevelopment; heritage and conservation; and urban form, including concepts and approaches such as the new urbanism and the compact city. These are addressed in relation to South Africa and Johannesburg in particular.

Course Code: ARPL 2017A**Course Description: Histories, Theories and Futures of Planning****NQF Credits: 12****NQF Level: 6**

The course introduces the idea and practice of planning as it evolved from the nineteenth century to the present day in South Africa and internationally. The course covers different histories of planning, illustrating both its successes and failures and the extent to which it has been shaped by different contexts and factors. The intellectual basis of planning and the developments regarding theory from modernism, pragmatism, post-modernism and the impacts of collaborative and insurgent planning are reviewed. International histories and theories are interrogated from a South African perspective, examining changes in planning and the city from apartheid to post-apartheid contexts.

Course Code: ARPL 2018A**Course Description: Introduction to Environmental Planning****NQF Credits: 12****NQF Level: 6**

The course provides a critical perspective on the notions of “the environment,” “sustainability,” “sustainable development” and the “sustainable city” and focuses on the relationship between the environment and urban development. It introduces students to the fundamentals of ecology and inter alia, the overall concepts of and tools associated with Environmental Assessment (EA), Integrated Environmental Management (IEM) and Strategic Environmental Assessment (SEA).

Course Code: ARPL 2019A**Course Description: Design Representation II****NQF Credits: 10****NQF Level: 6**

This course focuses on:

- 1) Intermediate forms of design and architectural representation and production, through targeted design/representation projects;
- 2) Design and creative production through a selection of representational media.

Course Code: ARPL 2020A**Course Description: Digital Applications in Architecture II****NQF Credits: 10****NQF Level: 6**

This course focuses on intermediate digital architectural production and elaborates on the use of contemporary industry-relevant software to create intermediate forms of architectural production, preparing for advanced methods of architectural design and representation.

Course Code: ARPL 2021A**Course Description: Introduction to Structures****NQF Credits: 7****NQF Level: 6**

This course introduces structural systems in the architectural and building construction fields, presents a survey of structural types and their relationship to the design of buildings. It includes a conceptual introduction to structural principles is presented and their influences on architectural design is analysed.

Course Code: ARPL3002A**Course Description: Small Office Practice****NQF Credits: 7****NQF Level: 7**

This course focuses on the concept of professionalism, architect/client relationships, consultant teams, small-scale contracting, contract ‘without bills of quantities’, elementary estimating, computer packages, certificates and final accounts, forms of architectural practice, financial planning, taxation, staffing, standard documents, managing projects and marketing professional services.

Course Code: ARPL3005A**Course Description: Architectural Design and Theory III****NQF Credits: 70****NQF Level: 7**

This course explores the conceptual and technical development of varied and complex architectural projects by using a pluralistic approach to architecture and a range of design approaches and methodologies. The ability to holistically complete an architectural project is emphasised through the integration of building systems with cohesive conceptual, technical, aesthetic and sustainability objectives.

Course Code: ARPL3010A**Course Description: Comparative Planning Systems****NQF Credits: 12****NQF Level: 7**

This course introduces students to different systems and forms of planning across the world. It illustrates the contextuality of planning, and different possibilities for future planning practice in South Africa. It relates comparative planning systems to different forms of government, and traditions of planning. The course makes extensive use of Internet searches.

Course Code: ARPL3012A**Course Description: Comparative Approaches to Urban Design****NQF Credits: 24****NQF Level: 7**

This course equips students with the theoretical basis for designing within a contemporary context. It introduces students to the economic, social and political factors that influence design at different scales. Topics include urban design process, urban revitalisation, gender and design, public safety, participatory design, principles of layout, pedestrians and vehicles and open space networks and landscapes. It focuses on developing concepts of urban design appropriate to African cities, including those relating to the upgrade of in-situ informal settlement, low income housing, regeneration of decaying inner-cities, design for informal activity, design and management of edge cities and design response to cultural diversity. The course includes a project which involves the use of appropriate digital technologies.

Course Code: ARPL3013A**Course Description: Housing Theory, Law and Policy****NQF Credits: 24****NQF Level: 7**

This course focuses on theories relevant to an understanding of housing, key concepts in the field of housing, key pieces of legislation that affect housing, major institutions in the delivery of housing in South Africa, mechanisms for financing of housing, international shifts in housing policy since the 1960's and shifts in policy within South Africa.

Course Code: ARPL3021A**Course Description: Histories and Theories of Architecture III****NQF Credits: 20****NQF Level: 7**

This course explores architectural histories and theories since modernism. It surveys both built and imagined architecture and how social emancipation, globalisation and media have characterised its production. The course extends knowledge of recent architecture and builds critical skills.

Course Code: ARPL3023A**Course Description: Politics, Governance and the City****NQF Credits: 24****NQF Level: 7**

This course focuses on theories of urban regimes, urban governance, participation, social movements and political mobilisation are presented and their relevance for African cities debated through different case studies.

Course Code: ARPL3034A**Course Description: Integrated Development Planning****NQF Credits: 24****NQF Level: 7**

This course has two components.

- 1) The theoretical component which focuses on the different approaches to integrated planning and international precedents, planning in relation to 'developmental local government', the historical development and legal basis of the South African Integrated Development Plan (IDP) and a critical review of integrated development planning practice in South Africa.

- 2) The practical component and consists of a project that introduces students to the IDP process, the integration of planning and institutional processes and the linkages between key sectors such as transportation and land use and economy and the environment. The project involves the preparation of a planning framework for a selected municipal area. Critical engagement with the regional context, key issues and relevant development approaches situates the project within a broader conceptual framework drawn from international and local literature.

Course Code: ARPL3027A

Course Description: Regional Planning and Local Economic Development

NQF Credits: 12

NQF Level: 7

This course introduces students to planning at supra-local scales (ie. regional, national transnational) and to the theories and practices of regional and local economic development as they have evolved internationally and in the South African context. It locates changing ideas about regional and local economic development within theories and approaches to development. The course provides a historical overview of the histories and traditions of regional planning and local economic development internationally and with reference to South Africa, but largely focuses attention on contemporary approaches.

Course Code: ARPL3028A

Course Description: Development Policy and Processes in South Africa

NQF Credits: 12

NQF Level: 7

This course introduces students to the rationale for public policy, the policy-making process, frameworks of policy analysis, decision-making models, and current trends in the policy-making environment internationally and in South Africa. Through close examination of current policy frameworks, the course provides an introduction to key policy issues that affect planning and development in Southern Africa, such as urbanisation and informal settlement, land tenure and governance in rural areas, land reform and land restitution, developmental local governance, the developmental effects of HIV/Aids and gender and development.

Course Code: ARPL3029A

Course Description: Spatial and Design Principles

NQF Credits: 18

NQF Level: 7

This course introduces students to the fundamental body of archetypal design principles that demonstrates how to create unique and profound physical and social form as they become integrated within a broad range of specific cultures, buildings, physical settings and a structure for the making of good places for people. It explores how the accommodation of human activities and purposes is, in part, a response to specific physical settings, particular historical and cultural contexts, evocative materials and methods of construction, recurring, archetypal strategies for organising space and the need for spatial structure that will remain useful and meaningful over time. The course emphasises place making in different social and cultural contexts together with an application of planning graphic communication and technologies.

Course Code: ARPL3030A

Course Description: Applications in Graphic and Spatial Communication in Planning

NQF Credits: 12

NQF Level: 7

This course is designed to equip students with the necessary tools and skills to apply the use of mapping, graphic and presentation tools/techniques acquired in previous years. It introduces and develops the skills of plan and framework interpretation at various scales ranging from the precinct and ward levels to national scales. Content assists students with honing graphic communication, using maps to analyse and communicate complex issues and dynamics, translating social, economic and political data onto readable maps, graphs and graphic inputs, articulating and illustrating spatial change and transformation.

Course Code: ARPL3031A

Course Description: Theory and Practice of Construction III

NQF Credits: 33

NQF Level: 7

This course focuses on the design development and detail design of large scale and complex building types, detailed consideration of services and building infrastructure, sustainable construction and design as a way to improve the environmental and maintenance performance of buildings through designing with the natural environment, climate, comfort, energy, water, resources, efficient structures, materials, daylighting and landscaping. It emphasises the application and adherence to the relevant National Building Regulations including SANS10400 and introduces industrialised building systems, specifications, approaches to environmental control and performance modelling and the preparation of detailed technical documentation.

Course Code: ARPL3033A

Course Description: Local Planning and Urban Design

NQF Credits: 18

NQF Level: 7

This course develops theoretical and practical skills in local physical planning and urban design. It introduces the economic, social, political and institutional factors that influence urban design. Topics include urban design process, urban revitalisation, gender and design, public safety, participatory design, principles of layout, pedestrians and vehicles and open space networks and landscapes, land use management as well as site development specifications. It focuses on developing concepts of urban design appropriate to African cities, including those relating to the upgrade of informal settlements, low income housing, regeneration of decaying inner-cities, design for informal activity, design and management of edge cities and design response to cultural diversity. The course includes a project which involves the use of appropriate digital technologies.

Course Code: ARPL3032A

Course Description: The Politics of Planning and Housing

NQF Credits: 30

NQF Level: 7

This course focuses on city governance and the politics of this, addressing theories of urban regimes, urban governance, participation, social movements and political mobilisation. It further explores housing theories, concepts and debates, and low income housing policy and practice, particularly in South Africa. The course connects urban politics with housing in exploring issues of power in urban development, and the implications thereof. The course includes a project focused on building research skills.

Course Code: ARPL4000A

Course Description: Advanced Design Studio

NQF Credits: 45

NQF Level: 8

This course focuses on an aspect of contemporary architectural and/or urban design.

Course Code: ARPL4001A

Course Description: Design Studio

NQF Credits: 45

NQF Level: 8

This course focuses on contemporary design studio in the fields of housing, urban design or architecture.

Course Code: ARPL4002A

Course Description: Contemporary Architectural Theory

NQF Credits: 18

NQF Level: 8

This course focuses on the theoretical readings of and research into architecture drawn from the fields of critical theory, cultural studies, gender studies, urban studies, postcolonial theory etc., and research methods.

Course Code: ARPL4003A

Course Description: Advanced Theory and Practice of Construction

NQF Credits: 18

NQF Level: 8

This course focuses on the design and construction implications of environmental sustainability requirements, renewable resources (solar energy and passive design, daylighting, rainwater harvesting), energy, water, environmental and resource conservation in architecture, confronting construction and design-related issues in the context of limited material, financial and energy resources; developing employable skills and providing employment; the impact of AIDS on the building industry and research methods.

Course Code: ARPL4004A

Course Description: Advanced History of Architecture and Urbanism

NQF Credits: 18

NQF Level: 8

This course focuses on the interrogation of modern architecture and urbanism, with an emphasis on the developing world, comparisons between local and other international contexts and historical research methods.

Course Code: ARPL4005A

Course Description: Research Project

NQF Credits: 36

NQF Level: 8

In this course, students are required to undertake research in a particular field of architecture, such as history, technology, theory or professional practice, including field, archival and /or laboratory work.

Course Code: ARPL4014A

Course Description: Advanced Planning Thought

NQF Credits: 20

NQF Level: 8

This course provides the candidates with an opportunity to engage in an in-depth reading of planning theory. It builds on their undergraduate understanding of the intellectual tradition in planning, and through seminar, the candidates explore the links between social, economic and political theories and various forms of planning practice.

Course Code: ARPL4027A

Course Description: Integrated Planning Project

NQF Credits: 30

NQF Level: 8

This course expands the candidates' undergraduate spatial planning knowledge and skills. It centres on a project, and through group and individual work, candidates prepare a spatial framework for a locality that co-ordinates development across sectors, promotes sustainable development, and may cut across a range of spatial scales. In this way, they consolidate their understanding of aspects of planning and demonstrate their abilities to formulate integrative, strategic and context- appropriate urban development proposals.

Course Code: ARPL4028A

Course Description: Research Design for Planners

NQF Credits: 10

NQF Level: 8

The course explains the principles in formulating a planning research problem and it exposes candidates to a range of methodological approaches. During the course, each candidate prepares a proposal which will form the basis for their research report, by generating clear research aims and questions and formulating a conceptual framework based on relevant planning development literature.

Course Code: ARPL4029A

Course Description: Research Report

NQF Credits: 60

NQF Level: 8

This course provides candidates with a practical understanding of research through the preparation of a 15-20,000 word report that addresses a research problem relating to the field of urban and regional planning. With the guidance of a supervisor, each candidate undertakes research on a defined topic, reviews the relevant literature, applies an appropriate conceptual framework and research methods, collects data and analyses their findings, and develops conclusions and recommendations based on their research.

Course Code: ARPL4030A**Course Description: Planning Law****NQF Credits: 20****NQF Level: 8**

This course involves an in-depth study of certain relevant areas of the law against the background of the history, general principles and sources of our legal system. Relevant legislation, such as the South African Constitution and those dealing with spatial development, environmental management, and housing, as well as court decisions are the point of departure. Candidates should acquire an understanding of the basic principles of South African law, knowledge of the law relevant to urban and regional planning, as well as an ability to read, interpret and apply relevant legislation and case law in practical situations.

Course Code: ARPL4031A**Course Description: Professional Practice and Ethics****NQF Credits: 10****NQF Level: 8**

This course introduces candidates to the planning profession and assists in preparing them for the 'world of work'. Through discussion-based sessions, they consider the historical development of the planning profession in South Africa, what it means to be a professional, as well planning ethics. Candidates are exposed to the professional bodies and acquire an understanding of the current job market, and different forms of practice. Their existing skills are enhanced through practical exercises in skills required of entry-level planners.

Course Code: ARPL5004A**Course Description: Cities, Development and Planning****NQF Credits: 20****NQF Level: 8**

This course explores the main dynamics and processes shaping cities in the contemporary era and the key challenges they face by examining both the international literature and the literature in the South African context. Major international development agendas for urban development, and their implications for urban planning, the evolution of approaches to urban development and the way they have been framed by development thought is discussed and contemporary approaches are evaluated.

Course Code: ARPL5005A**Course Description: Spatial Planning, Transport and Infrastructure****NQF Credits: 30****NQF Level: 8**

This course has two components.

- 1) Spatial planning processes: Focuses on spatial concepts and principles of spatial planning, as well as various processes and theories of spatial change and requires the development of a local level spatial plan, including spatial analysis, spatial policies, design and implementation, issues such as land tenure, settlement layout and morphology and land use management.
- 2) Sustainable transportation and infrastructure: Introduces students to issues dealing with the impact of urban land use and form and other factors on sustainable transport, types of transport and finally transport policies and their implementation. Urban infrastructure will introduce students to the principles of bulk infrastructure provision such as potable water supply, storm water and waste water provision as well as roads and side walk construction. It also deals with the relationship between urban form and infrastructure provision in terms of sustainable infrastructure, and costings.

Course Code: ARPL5007A**Course Description: Technologies and Techniques of Planning****NQF Credits: 10****NQF Level: 8**

This course introduces candidates to procedural and analytical techniques used in planning and involves the practical application of appropriate technologies, including Geographic Information Systems (GIS), Internet, and computer packages for data analysis and the presentation of graphics.

Course Code: ARPL5008A**Course Description: Planning, Environment and Sustainability****NQF Credits: 20****NQF Level: 8**

This course has two components.

- 1) The concepts of sustainability and sustainable development are introduced, a critical perspective provided and the notion of the “sustainable city” is covered.
- 2) Environmental planning introduces candidates to ecological fundamentals, environmental ethics, the idea of environmental risk and the basics of environmental and resource economics. The various forms of environmental management and planning, including Environmental Impact Assessment (EIA), Integrated Environmental Management (IEM), and Strategic Environmental Assessment (SEA) are covered.

Course Code: ARPL5009A**Course Description: Urban and Regional Economic Development****NQF Credits: 20****NQF Level: 8**

The course provides candidates with concepts, knowledge and tools in economic development for analysing and understanding the dynamics of local and regional economic development and engages theoretical approaches for the understanding of urban economics, local economic development and regional development. Candidates must assimilate the dynamics of location, distribution and spatial organisation of economic activities and their implications for the configuration of urban forms and human development at local, regional and national levels.

Course Code: ARPL5010A**Course Description: Integrated Development Planning****NQF Credits: 20****NQF Level: 8**

This course is project based and has two components.

- 1) The theoretical component deals with different approaches to integrated planning and international precedent, planning in relation to ‘developmental local government’, the historical development and legal basis of the South African Integrated Development Plan (IDP), and a critical review of integrated development planning practice in South Africa.
- 2) The practical component introduces candidates to the IDP process, the integration of planning and institutional processes, the linkage between key sectors such as transportation and land use, and economy and the environment. The project involves the preparation of a planning framework for a selected municipal area.

Course Code: ARPL5011A**Course Description: Planning Law****NQF Credits: 20****NQF Level: 8**

This course involves an in-depth study of certain relevant areas of the law against the background of the history, general principles and sources of our legal system. Relevant legislation, such as the South African Constitution and those dealing with spatial development, environmental management, and housing, as well as court decisions are the point of departure. Candidates should acquire an understanding of the basic principles of South African law, knowledge of the law relevant to urban and regional planning, as well as an ability to read, interpret and apply relevant legislation and case law in practical situations.

Course Code: ARPL5012A**Course Description: Professional Practice and Ethics****NQF Credits: 10****NQF Level: 8**

This course introduces candidates to the planning profession and assists in preparing them for the 'world of work'. Through discussion-based sessions, they consider the historical development of the planning profession in South Africa, what it means to be a professional, as well planning ethics. Candidates are exposed to the professional bodies and acquire an understanding of the current job market, and different forms of practice. Their existing skills are enhanced through practical exercises in skills required of entry-level planners.

Course Code: ARPL7001A

Course Description: Advanced Digital Applications

NQF Credits: 9

NQF Level: 9

This course is an introduction to specialised computer applications appropriate to architecture, e.g. desktop publishing, programmes for specialised technical analysis, programmes for specialised research, professional practice, etc.

Course Code: ARPL7002A

Course Description: Simulated Office Practice

NQF Credits: 45

NQF Level: 9

In this course students must apply the principles of professional practice in the context of a functioning simulated office: topics include: forming and establishing business associations: office organisation and management; marketing; business plans and feasibility studies; design and working drawings; schedules and related contract documents; the tender process; community facilitation and training; appropriate communication techniques and computer applications; site meetings and instructions; final accounts.

Course Code: ARPL7003A

Course Description: Architectural Design and Discourse

NQF Credits: 90

NQF Level: 9

This course is a supervised, integrated research and design on an independently motivated topic approved by the Senate. The topic is required to include research design and technical components.

Course Code: ARPL7004A

Course Description: Housing Theories, Concepts and Policy

NQF Credits: 20

NQF Level: 9

This course enables candidates to cite and analyse key local and international theories, concepts and ideas in the field of housing, develop theoretical and conceptual frameworks, apply these to housing policy and practice, critically evaluate existing policy and develop new policy.

The following topics are discussed:

- 1) theories relevant to an understanding of housing (its production and its inadequacies, including informal/illegal housing);
- 2) neo-Marxism/Structuralism, Political Economy, Liberalism, Positivism / Modernisation, Structure and Agency;
- 3) concepts currently applied to housing and urban poverty, including Sustainability, Livelihoods, Assets and Vulnerability, Commodification, Civil Society, Exclusion, Patronage, Governance and Participation, Enablement, Devolution, Decentralisation and Autonomy;
- 4) international shifts in housing policy since the 1960s the role of organisations such as the World Bank, the United Nations, and Local Government;
- 5) shifts in South African housing policy and their socio-political and economic underpinnings; and
- 6) A comparative understanding of policy shifts in other developing countries.

Course Code: ARPL7005A**Course Description: Social and Technical Sustainability in Housing****NQF Credits: 20****NQF Level: 9**

This course enables candidates to critically analyse the interaction between housing and the social/cultural, economic and biophysical environment; to develop approaches to enhance sustainability of housing and mitigate negative impacts; and to sensitively and constructively engage with local communities and service providers to identify and tackle housing challenges. It assists candidates to understand various strategies applied in housing in order to mitigate negative impacts on other systems while enhancing the positive impacts. Using the concept of performance criteria and indicators, candidates will be able to understand decision-making and strategy prioritisation for sustainability in housing. The content of the course includes energy conservation (embodied energy and energy-in-use), water conservation, resource conservation (inputs to component production and assembly), indoor and outdoor air quality, urban environmental management (especially waste management), job creation and skills development, market transformation and sustained implementation of strategies. The socio-cultural component of this course addresses issues of exclusion, displacement, illegality and gender and generational biases as well as health issues such as HIV/Aids. It covers conceptual and theoretical debates as well as practical approaches that have been developed in response to these problems. The importance of inter-sectoral interventions is discussed.

Course Code: ARPL7006A**Course Description: Advanced Housing Finance****NQF Credits: 20****NQF Level: 9**

This course enables candidates to engage with housing finance challenges at an advanced level and from a well-developed theoretical and conceptual position, builds on the courses 'Housing Finance and Law' and 'Housing Construction Technology and Management' and involves an advanced discussion of the sources of housing finance and the need for housing policy to integrate these. The course critically considers the points below, and is based on an understanding of cost factors relating to housing provision in different contexts, and the practical aspects of design, procurement and cost planning:

- 1) the positions of international agencies, governments, banks, developers, civic organisations/civil society and end-users
- 2) various models for the structuring and release of government resources or subsidies, private sector finance, end-user finance, credit and savings mechanisms
- 3) gaps and blockages in housing finance for different sectors of society
- 4) the relationship between housing finance and the nature of the built environment and living conditions
- 5) the causes of standardisation, fragmentation and segregation in the built environment

Through local and international case studies, housing finance approaches are explored that might overcome key inadequacies in South African low cost housing environments.

Course Code: ARPL7007A**Course Description: Housing Seminar****NQF Credits: 20****NQF Level: 9**

This course enables candidates to undertake analysis, synthesis and application in an area of housing specialisation by engaging with complex housing challenges and identifying and solving complex problems by developing theoretically grounded reflected approaches. The course exposes candidates to contemporary cutting edge issues locally and internationally in housing, that fall outside of the compulsory coursework.

Course Code: ARPL7010A**Course Description: Understanding Cities of the South****NQF Credits: 20****NQF Level: 9**

This course focuses on understanding the many forces that shape cities of the south, which includes development processes (legal, economic (formal and informal), governance issues, environmental issues, transport, land use, infrastructure, services etc.), power and politics (macro-economics, structural adjustment, questions of sovereignty, gender, poverty, inequality etc.) and the discourses of modernity, globalisation and post-colonialism.

Course Code: ARPL7011A

Course Description: Urban Design Theory and History

NQF Credits: 20

NQF Level: 9

This course focuses on urban design paradigms and theories and urban morphologies including that of premodern, modern, colonial and post-colonial cities (focusing on cities of the south).

Course Code: ARPL7029A

Course Description: Philosophies, Theories and Methodologies of Development Planning

NQF Credits: 20

NQF Level: 9

This course has two components:

- 1) The first component introduces candidates to the idea and history of development, the institutions of development, theoretical approaches to development, and key themes within development such as gender and sustainability.
- 2) The second component provides candidates with an overview of the theories and philosophies of planning and includes procedural rationalism, neo-Marxist critique, and post-positivist philosophies that focus on issues such as power and communication.

Course Code: ARPL7030A

Course Description: Municipal Planning

NQF Credits: 20

NQF Level: 9

This course focuses on municipal planning within the context of 'developmental local governance' and includes municipal powers, structure and functions, municipal finances, the international experience with municipal planning, the history and theory of integrated development planning, planning process, sectoral plans and integration of these plans, the planning and delivery of municipal infrastructure, project packaging, performance management and is linked to a project, and may include a service learning component.

Course Code: ARPL7032A

Course Description: Planning, Environment and Sustainability

NQF Credits: 20

NQF Level: 9

This course has two components and covers various forms of environmental management and planning, including Environmental Impact Assessment (EIA), Integrated Environmental Management (IEM), and Strategic Environmental Assessment (SEA).

- 1) The first component introduces and provides a critical perspective on the concepts of sustainability and sustainable development and with the notion of the "sustainable city."
- 2) The second component, environmental planning introduces candidates to ecological fundamentals, environmental ethics, the idea of environmental risk and. thereafter the course deals with the basics of environmental and resource economics

Course Code: ARPL7034A

Course Description: Specialised Topics in Planning

NQF Credits: 20

NQF Level: 9

This course focuses on a range of theories relevant to understanding specialised topics in the planning field.

Course Code: ARPL7040A**Course Description: Research Methods****NQF Credits: 10****NQF Level: 9**

The course familiarises candidates with research methods, articulation of research questions and identification of types of data (qualitative or quantitative), the different methods of data collection, with an additional emphasis on conducting surveys, approaches to analysing both qualitative and quantitative data. In particular candidates will gain an applied understanding of statistics in analysis of quantitative data through the use of statistical programs.

Course Code: ARPL7041A**Course Description: Architectural Professional Practice****NQF Credits: 36****NQF Level: 9**

This course focuses on managing medium to large-scale complex building projects, from inception to completion. It includes appropriate contracts, managing community based projects in a developmental context, the implications of information technology and globalisation on architectural practice, introduction to marketing, introduction to project management and sub-contracting, laws of arbitration and of sectional title and their application. It also focuses on the law in relation to architectural practice: environment; conservation; heritage, general principles of contract, company law and partnership, tax law, protection of property rights and professional responsibilities.

Course Code: ARPL7044A**Course Description: Community Participation in Urban Governance: Theories, Discourses and Practice****NQF Credits: 20****NQF Level: 9**

The course critically engages with development and planning theories, 'good governance' discourses and political literature (from the local to the global levels), and question them in particular through the study of the practices of community participation and the various types of challenges these practices entail with a particular focus at empowering students to communicate their findings to different audiences, using different methodologies and in particular graphic devices.

Course Code: ARPL7048A**Course Description: Democratic Theory****NQF Credits: 20****NQF Level: 9**

This course examines some key issues and developments in democratic theory. The first component covers basic questions about democracy: its definition, history, rival traditions, justification and key problems and the second component examines a range of democratic models, techniques and arenas. The historical theory and practice of democracy and proposals for extending and deepening democracy in the future is covered.

Course Code: ARPL7049A**Course Description: Politics, Governance and the City****NQF Credits: 20****NQF Level: 9**

This course provides theoretical as well as practical responses to questions on governance, policy implementation decisions, the role of business on urban settings and the power of residents associations in urban governance. In addition, theories of urban regimes, urban governance, participation, social movements and political mobilisation will be presented and their relevance for African cities debated through different case studies.

Course Code: ARPL7050A**Course Description: The Making of Urban South Africa****NQF Credits: 20****NQF Level: 9**

The course explores through a series of questions, the social, political and economic history of urbanization in South Africa from the late 19th to the late 20th centuries, and considers the consequences of these processes on the contemporary state of cities and towns with a central focus is the Witwatersrand, but it also examines parallel and especially divergent processes in Cape Town, Durban, East London, Bloemfontein, Port Elizabeth and Pretoria.

Course Code: ARPL7051A

Course Description: Violence, States, Movements

NQF Credits: 20

NQF Level: 9

This course explores the relationship between the form of the state, violence, and collective forms of action (in particular social movements), as well as forms of resistance through the experience of South Africa, contextualising and relating this to changing patterns of collective action, resistance and violence globally. Theoretical questions and debates about power, resistance, forms of political engagement, struggle and organising, and strategies for effecting change (inter alia) will be engaged through relevant case studies.

Course Code: ARPL7052A

Course Description: Technologies and Techniques for the Built Environment

NQF Credits: 10

NQF Level: 9

The course introduces procedural and analytical techniques used in planning and involves the practical application of appropriate technologies, including Geographic Information Systems (GIS), computer based mapping and computer packages for data analysis and the presentation of graphics.

Course Code: ARPL7054A

Course Description: Energy for Sustainable Cities

NQF Credits: 20

NQF Level: 9

The course covers five key topics:

- 1) Global and urban energy mix and challenges
- 2) Urban scale EE and RE strategies
- 3) Operational building-scale EE and RE strategies
- 4) Embodied energy strategies
- 5) Markets, policies, programmes, legislation and institutional structures

Course Code: ARPL7055A

Course Description: Energy Efficiency and Renewable Energy for Buildings

NQF Credits: 20

NQF Level: 9

The course covers five key topics:

- 1) Motivation, brief and assessment tools for EE and RE for buildings
- 2) Integrated design concept for EE and RE for buildings
- 3) Design development in EE and RE for buildings
- 4) Procurement and post-occupation monitoring for EE and RE integrated buildings
- 5) EE and RE retrofit for existing buildings

Course Code: ARPL7057A

Course Description: Urban Design Professional Practice

NQF Credits: 10

NQF Level: 9

The course introduces candidates to tools, strategies and regulation in preparation of an urban design project: eg. town planning regulations, different forms of implementation (eg. public/private partnerships), procedural development, coding and conservation guidelines, and developmental rights. Candidates are exposed to project management and dispute resolution and issues related to running an urban design practice, such as forms of practice, concepts around professionalism, and professional bodies and ethics. Part of the course is also devoted to reviewing building contracts and dealing with issues of sub-contracting.

Course Code: ARPL7058A**Course Description: Global City Studio****NQF Credits: 10****NQF Level: 9**

This course focuses on global and cosmopolitan aspects of cities, explores international economic and trade linkages through event cities (world cups, Olympics etc.), tourism, and world heritage sites and emphasises other global forces expressed through catalytic projects, gating, and R D communities.

Course Code: ARPL7059A**Course Description: Accessible City Studio****NQF Credits: 10****NQF Level: 9**

This course focuses on issues of urban accessibility: socio-economic issues, informalisation, migrants, immigrants and refugees, movement and transportation, inclusiveness and exclusiveness, human rights, gender, children, aged and groups with special needs and poverty.

Course Code: ARPL7060A**Course Description: Sustainable City Studio****NQF Credits: 10****NQF Level: 9**

This course focuses on the design of open space systems, landscape and natural settings and urban infrastructure of sustainable cities by investigating how landscape and natural issues intersect with built form consideration through urban development infrastructure, sprawl vs. compact cities, and energy and resources.

Course Code: ARPL7061A**Course Description: Transforming City Studio****NQF Credits: 10****NQF Level: 9**

This course focuses on transforming cities and includes the following themes: post-colonial cities, habitable cities, fragmented and segregated cities, communities in transition, and informalisation.

Course Code: ARPL7063A**Course Description: Governance and Municipal Planning****NQF Credits: 20****NQF Level: 9**

This course focuses on municipal planning within the context of 'developmental local governance' and covers the following topics:

municipal powers; structure and functions; municipal budgeting systems; the international experience with municipal planning; South African forms of planning; planning process; sectoral plans and integration of these plans; the planning and delivery of municipal infrastructure; project packaging; and performance management.

Course Code: ARPL7066A**Course Description: Housing Finance and the Law****NQF Credits: 20****NQF Level: 9**

This course which covers international and local perspectives on housing finance enables candidates to analyse existing and proposed legislation and financial frameworks for housing, cite and analyse key positions on legal and financial aspects of housing locally and internationally, apply these in judging the appropriateness of legal and financial approaches in a given context and develop relevant housing approaches that might overcome key inadequacies in South African low cost housing environments.

Course Code: ARPL7067A**Course Description: Management of Existing Housing Stock****NQF Credits: 20****NQF Level:9**

This course introduces the basic tools and techniques for running and managing existing housing stock. It highlights the basic principles of property management, issues of renting and leasing, facilities management, life-cycle costing, obsolescence management, corporate and labour policies, project feasibility and management, implementation procedures, marketing and sales administration, cultural and human relations matters, and the planning, organisation and execution of regular maintenance works.

Course Code: ARPL7068A**Course Description: Housing Construction Technology and Management****NQF Credits: 20****NQF Level:9**

This course provides candidates with an understanding of, and insight into, the principles of housing construction technology and management so they can put together a housing construction project, organising construction sites, managing material supply and production, ensuring structural and environmental standards and deal with fire risks and prevention. It provides candidates with basic knowledge on the technology of housing modernisation and safety so they can analyse and synthesise various technological and managerial issues of housing and make informed decisions from them.

Course Code: ARPL7071A**Course Description: Theory and Practice of Urban Management****NQF Credits: 20****NQF Level:9**

This course introduces the field of urban management through four critical dimensions: managing the politics of policy, managing change in participatory ways, effecting relevant integration, and navigating between theory and practice. This course cuts them to four dimensions and engages critically with the urban economy. This interactive course explores its themes through case studies of urban management practice in selected cities across the world, with an emphasis on the Global South. Through a local field trip and engagement with urban managers, the course connects candidates with real life praxis in a reflective manner. It allows candidates to develop their own position on urban management and provides a critical frame for the remaining modules in the MUS (Urban Management) field.

SCHOOL OF CHEMISTRY**Course Code: CHEM1012A****Course Description: Chemistry I (Major)****NQF Credits: 36****NQF Level:5****(36) (3-2-1½) (2 terms)**

Students who wish to proceed to Chemistry II Major after completing this course need to achieve a minimum pass mark of 60%.

This course is the study of matter and the changes that matter undergoes. It is often considered to be the 'central science' because of its importance to diverse areas of science and engineering. Chemistry draws on the language of mathematics and the laws of physics to describe the world around us from a chemical, biological and physical point of view. It plays a vital part in our understanding of the structure and the interactions of matter, and it is crucial for a thorough understanding of disciplines as diverse as geology, molecular biology, biotechnology, medicine, materials science and environmental studies. This course covers the introductory aspects of chemistry essential for further studies towards a BSc in Chemistry or degrees that require a general first-year background in the subject. Experimental work related to this material, including quantitative analysis, will be carried out in the first year laboratories throughout the year.

Semester 1: Students are introduced to the concepts of matter and measurement; atoms, molecules and ions; stoichiometry and calculations with chemical formulas and equations. This is followed by a study of aqueous reactions, including acid-base reactions and solution stoichiometry. The fundamental description of matter from a chemistry point of view, including aspects such as, electronic structure of atoms, periodic properties of the elements, basic concepts of chemical bonding, molecular geometry and bonding theories and the properties and theory of gases is then covered in some detail, followed by an introduction to organic chemistry.

Semester 2: Organic chemistry (including polymers and molecules of life); an introduction to coordination compounds, intermolecular forces, liquids and solids and properties of solutions is given, followed by physical chemistry topics such as thermochemistry, chemical kinetics, chemical equilibrium, chemical thermodynamics, electrochemistry and additional aspects of acid-base equilibria and aqueous equilibria.

Course Code: CHEM1051A/CHEM1053A (PT)

Course Description: Engineering Chemistry

NQF Credits: 12

NQF Level: 5

This course describes the basic concepts of chemistry in engineering and provides an understanding of the chemical view of matter. Topics include the modern view of atomic structure including isotopes, atomic numbers and mass numbers, balanced chemical equations, aqueous reactions and solution stoichiometry, concepts of equilibrium and equilibrium constants, concepts of acids and bases, thermochemistry and chemical thermodynamics, laws of thermodynamics, concepts of internal energy, enthalpy and entropy and modern materials such as ceramics and polymers.

Course Code: CHEM2032A

Course Description: Engineering Chemistry IIA

NQF Credits: 18

NQF Level: 6

(18) (2-2-2)

The course covers the following topics in chemistry: statistics and error analysis; calibration methods, chemical equilibrium, volumetric analysis, acids and bases, buffers, complexometric titrations, precipitation reactions and crystallization, gravimetric analysis, electrochemistry, and a brief introduction to spectroscopy and chromatography.

Course Code: CHEM2033A

Course Description: Engineering Chemistry IIB

NQF Credits: 18

NQF Level: 6

(18) (2-2-2)

The course covers the following topics in chemistry: organic chemistry (nomenclature, functional groups, reaction types, polymers), thermodynamics (PV work, first law of thermodynamics, state & path functions, internal energy & enthalpy changes), thermochemistry (reaction energies, enthalpies and Kirchhoff's Law), entropy and the second & third laws of thermodynamics (Gibbs function, reaction spontaneity, and useful work), and chemical kinetics (rate laws).

SCHOOL OF CHEMICAL AND METALLURGICAL ENGINEERING

Course Code: CHMT2009A

Course Description: Introductory Mineralogy and Earth Sciences

NQF Credits: 9

NQF Level: 6

(9) (2-1-0) (1 term)

The course provides a basic understanding of the origin and formation of the Earth, rock forming minerals, rocks and minerals of economic value. Location, mode of formation and valuable mineral content of ore bodies in South Africa are explored. A brief review of the origin, formation, beneficiation, utilisation and properties of coal is offered.

Course Code: CHMT2011A/CHMT2020A (PT)**Course Description: Computing for Process Engineers****NQF Credits: 15****NQF Level: 6****(15) (3-2-0) (1 term)**

This course introduces key concepts in computer programming using a chosen high level language for performing calculations in areas relevant to process engineering. The core objective of the course is to introduce the student to programming logic and foster a basic computer programming proficiency, which may be applied to other fields in the future. The emphasis is on creating computer programs that perform calculations specifically related to unit operations in chemical and metallurgical plants, and not on producing professional programming code for others to use.

Course Code: CHMT2017A**Course Description: Introduction to Extractive Metallurgy****NQF Credits: 15****NQF Level: 6****(15) (4-1-0) (1 term)**

This course focuses on the fundamental principles of extractive metallurgy, and provides the fundamental knowledge on the unit processes involved in the extraction of minerals and metals. The course also focuses on the process flow sheet considerations in the metals and minerals extraction, including physical beneficiation processes, chemical and physicochemical concentration processes, and the chemical extraction processes required to extract metals from the metal-bearing minerals.

Course Code: CHMT2018A**Course Description: Practical Metallurgy****NQF Credits: 12****NQF Level: 6****(12) (2-0-2) (1 term)**

This course is a practical introduction to metallurgical engineering, laboratory experimental sessions in physical metallurgy, hydrometallurgy and minerals processing as per set guidelines, analysis, interpretation and presentation of the results of the lab exercise from both a technical and scientific basis in the form of a technical report based on the work carried out.

Course Code: CHMT2019A**Course Description: Materials Science and Engineering****NQF Credits: 15****NQF Level: 6****(15) (4-1-0) (1 term)**

This course provides a general introduction to engineering materials and the key concepts required for a number of third year courses. It covers the following topics: the selection of the main engineering materials industry applications; the relationships between material structure, processing methods, mechanical properties and product performance; common metals processing methods used in industry; material structures; interpretation of phase diagrams and defects in materials; basic mechanical properties of materials.

Course Code: CHMT2021A/CHMT2022A (PT)**Course Description: Process Engineering Fundamentals A (CHEM)****NQF Credits: 20****NQF Level: 6****(20) (4-3-0)**

This course introduces chemical and metallurgical engineering students to the basic principles and calculation techniques used in process engineering. It acquaints the students with the fundamentals of material balances. The course focuses on both reactive and non-reactive material balances as applied to steady-state process systems and covers both single and multiple units including recycle, purge and bypass streams.

Course Code: CHMT2023A/CHMT2024A (PT)**Course Description: Process Engineering Fundamentals B (CHEM)****NQF Credits: 20****NQF Level: 6****(20) (4-3-0)**

This course builds on the fundamentals taught in previous courses and acts as a bridge to advanced courses and covers intermediate chemical engineering problems and an introduction to energy balances, heat transfer and fluid flow.

Course Code: CHMT2025A/CHMT2026A (PT)**Course Description: Process Engineering Fundamentals A (MET)****NQF Credits: 20****NQF Level: 6****(20) (4-3-0)**

This course introduces chemical and metallurgical engineering students to the basic principles and calculation techniques used in process engineering. It acquaints the students with the fundamentals of material balances. The course focuses on both reactive and non-reactive material balances as applied to steady-state process systems and covers both single and multiple units including recycle, purge and by-pass streams.

Course Code: CHMT3004A**Course Description: Chemical Engineering Laboratory****NQF Credits: 18****NQF Level: 7****(18) (1-0-5) (2 terms)**

In this course students must apply chemical engineering fundamentals, learnt in their second and third year of study in laboratory practicals where they are required to design an experiment in order to find the necessary data for the appropriate theory. Their work on the application of theory with a detailed analysis of the experimental data must be presented in a written technical report and an oral presentation.

Course Code: CHMT3008A**Course Description: Numerical Methods (Chemical)****NQF Credits: 12****NQF Level: 7****(12) (2-2-0) (1 term)**

In this course, topics covered include: direct and iterative methods for linear algebraic equations; computation of eigenvalues and eigenvectors; iterative methods for nonlinear equations; interpolation using both polynomials and cubic splines; least squares approximation; numerical differentiation; Richardson's extrapolation; numerical integration; methods for ordinary differential equations and methods for partial differential equations.

Course Code: CHMT3014A**Course Description: Engineering Failure Analysis****NQF Credits: 9****NQF Level: 7****(9) (2-1-0) (1 term)**

This course focuses on engineering problem-solving through the application of fundamental and specialist knowledge leading to the analysis of a failure related to elastic and/or plastic deformation as well as fracture of predominately metals. It introduces the student to failure analysis with an emphasis on stress analysis, deformation and typical case studies and is designed to equip the student to analyse fractographic features, failures induced by welded structures, microstructural effects on toughness and the role of stress concentrations. Topics include: fatigue failure; impact fracture; stress corrosion cracking; creep and fracture mechanics.

Course Code: CHMT3017A**Course Description: Biomedical Transport Phenomena****NQF Credits: 6****NQF Level: 7****(6) (2-0-0) (1 term)**

This course introduces students to basic mass balances, chemical reactions and unit operations, which are applied to various chemical engineering related topics in the biomedical engineering field. The emphasis is to derive and apply basic mass balances (non-reactive or reactive) either changing with time or length, in the body in order to describe how the system is working. The course also explores momentum balances, and application of mass balances to extracorporeal devices.

Course Code: CHMT3019A**Course Description: Kinetic and Transport Processes in Metallurgical Engineering****NQF Credits: 15****NQF Level: 7****(15) (4-1-0) (1 term)**

This course introduces the students to a number of key concepts such as the principles of heat, mass and momentum transport and their mathematical expressions; the principles of chemical kinetics for homogeneous and heterogeneous systems; reactions with diffuse phase boundaries; the treatment of heat, mass and momentum transfer problems in metallurgical engineering by interaction of chemical kinetics and transport processes; and solid-solid, solid-liquid, solid-gas, liquid-liquid, liquid-gas and solid-liquid-gas systems.

Course Code: CHMT3021A**Course Description: Solidification, Heat Treatment and Microstructure****NQF Credits: 15****NQF Level: 7****(15) (4-1-0) (1 term)**

This course, which focuses on the design of heat treatments for industrial application and, which explores the basic principles of solidification of metals, introduces students to key concepts in the development of microstructure in Fe-C alloys when subjected to different heat treatment processes. Topics include: TTT curves; CCT curves; annealing; normalising; tempering; hardenability; aging and surface heat treatments.

Course Code: CHMT3024A**Course Description: Environmental Process Engineering****NQF Credits: 9****NQF Level: 7****(9) (2-1-0) (1 term)**

This course provides students with a basic knowledge of environmental issues associated with the operation of chemical and metallurgical plants, with the intention of promoting sustainable development and the development of clean innovative technologies for industrial applications and pollution control. Topics include environmental legislation, current codes of practices, and health and safety risks pertinent to South African and global operations. It gives students the understanding needed to apply basic strategies for the prevention and treatment of waste, water, waste-water, and air pollution and the links between the different systems and the engineering professionalism and ethics required to understand the impact of engineering activity on the environment.

Course Code: CHMT3025A**Course Description: Crystal Structure and Analysis****NQF Credits: 12****NQF Level: 7****(12) (3-1-0) (1 term)**

This course equips students with an understanding of crystal structure and the effects of crystal structure on the properties of materials. It comprises of two components crystal structures and analytical techniques. Crystal structures cover different representations which are used and some common examples; an

introduction to stereographic projection and its use to analyse deformation in cubic materials; defects in crystals, and their effect on the mechanical properties of metals. Analytical techniques to be covered in the course include: X-ray diffraction and scanning and transmission microscopy (including EDX), used to analyse and characterize microstructure and crystal structure.

Course Code: CHMT3027A

Course Description: Corrosion and Wear

NQF Credits: 15

NQF Level: 7

(15) (3-1-1) (1 term)

In this course which explores the mechanisms of wear and methods to limit wear, with emphasis on materials selection provides students with a fundamental understanding of general corrosion and wear theory. It introduces key concepts in the thermodynamics, kinetics and electrochemistry of corrosion. Topics include electrochemistry techniques and test methods, corrosion and passivation of stainless steels, forms of corrosion, and prevention methods such as design, material selection, surface treatment and environmental control.

Course Code: CHMT3028A

Course Description: Non-Ferrous Pyrometallurgy

NQF Credits: 12

NQF Level: 7

(12) (2-1-1) (1 term)

This course equips students with the fundamental knowledge of physical chemistry applied to various high temperature processes encountered in the production of metals and alloys. It focuses on reduction smelting, sulphide smelting, converting, refining and fused salt electrolysis and the impact of pyrometallurgy on society and environment.

Course Code: CHMT3038A

Course Description: Momentum and Heat Transport

NQF Credits: 18

NQF Level: 7

(18) (3-3-0)

This course covers the derivation of the fundamental equations of momentum and energy transfer; application to the modelling of engineering systems by making simplifying assumptions and the solution of resulting differential equations using analytical and numerical techniques. Topics include laminar and turbulent flow in various geometries, heat transfer in solids and fluids, heat transfer with phase change (e.g. condensation, solidification), radiation heat transfer and furnace design.

Course Code: CHMT3039A

Course Description: Mass Transport and Operations

NQF Credits: 18

NQF Level: 7

(18) (3-3-0)

This course focuses on two aspects:

- 1) The fundamental mechanisms of mass transfer in gases, liquids and solids; and
- 2) The applications of the fundamental mechanisms of mass transfer to solving real engineering problems. It covers: fundamentals and equations of mass transfer; mass transfer theories; mass transfer design equations as applied to selected unit operations such as distillation; absorption/stripping and solvent extraction.

Course Code: CHMT3040A

Course Description: Applied Thermodynamics

NQF Credits: 12

NQF Level: 7

(12) (2-2-0)

The course first reviews the mathematical knowledge necessary to do the theoretical derivations, while introducing different notations. Included in the course is the introduction to the zeroth, first law, second law and third law of thermodynamics, and the thermodynamic postulates. Aspects covered will be generation of entropy, flow processes and power generating processes such as engines, 'heat' pumps, compressors and turbines; refrigeration and power cycles, exergy, thermodynamic analysis of the chemical plant, and thermodynamic efficiency in order to derive useful results.

Course Code: CHMT3041A

Course Description: Chemical Engineering Thermodynamics

NQF Credits: 12

NQF Level: 7

(12) (2-2-0)

This course through the knowledge of the zeroth, first, second and third law of thermodynamics, and the thermodynamic postulates, seeks to derive useful results with respect to phase and chemical equilibrium in one-component and multicomponent systems using Gibbs functions. It covers: fugacity, activity coefficients; equilibrium between phases, the equilibrium constant for chemical reactions in all phases at low and high pressures; and energy balance for chemical reactors and auto thermal behaviour.

Course Code: CHMT3042A

Course Description: Chemical Reaction Engineering A

NQF Credits: 12

NQF Level: 7

(12) (2-2-0)

This course covers the design of ideal reactors (batch, semi-batch, continuous stirred tank reactors, and plug flow reactors) for homogeneous reactions at isothermal and non-isothermal conditions, with and without pressure drop (packed bed reactors). It also covers equilibrium and multiple reactions and the design of ideal reactors in which these reactions occur.

Course Code: CHMT3043A

Course Description: Chemical Reaction Engineering B

NQF Credits: 12

NQF Level: 7

(12) (2-2-0)

This course covers heterogeneous chemical reactions engineering. It introduces catalysis engineering (catalysis & catalytic reactors): synthesis, characterisation and application catalysis theory, collection and the analysis of experimental rate data and the use of such data in the design of catalytic reactors. It also covers non-ideal reactors and residence time distribution as a diagnostic tool.

Course Code: CHMT3044A

Course Description: Process Design Principles A

NQF Credits: 12

NQF Level: 7

(12) (2-2-0)

This course introduces the fundamental principles of chemical process design with an emphasis on synthesis, integration and hierarchy-level understanding. The course covers the heuristic techniques important in process conceptualisation such as the evaluation of chemical processing alternatives, energy integration, thermodynamic constraints, reactor selection, separation strategies, environmental-safety-health (ESH) concerns, and process simulation using Aspen Plus software. The course also introduces students to the evaluation and improvement of chemical process designs in order to identify environmental impact, safety requirements, and human health constraints.

Course Code: CHMT3045A**Course Description: Process Design Principles B****NQF Credits: 12****NQF Level: 7****(12) (2-2-0)**

This course involves the design of standard equipment such as pumps, heat exchangers, compressors, etc., detailed design of major pieces of equipment, an estimate of the requirements for new materials and energy, also a calculation of total costs and detailed economical analysis, engineering safety and process optimisation. This course applies concepts learned in Chemical Design Principles A for a full-scale chemical process; Problem formulation, alternative design solutions and professional decision making are emphasized. Regulations, standards and codes related to design tasks are also introduced in order to bring students closer to real world engineering.

Course Code: CHMT3046A**Course Description: Metallurgical Thermodynamics I****NQF Credits: 12****NQF Level: 7**

This course introduces students to fundamentals of thermodynamics in detail. The course provides students with key concepts, examples and discussions on the first law of thermodynamics (internal energy, enthalpy and heat capacity, as well as constants volume, constant pressure, isothermal and adiabatic process paths); the second law of thermodynamics (entropy, reversibility and irreversibility and equilibrium); and free energy and equilibrium constants, reactions involving gases, gases and pure condensed phases, and Ellingham diagrams.

Course Code: CHMT3047A**Course Description: Metallurgical Thermodynamics II****NQF Credits: 12****NQF Level: 7**

This course provides an in-depth understanding of the thermodynamics of solutions, solution types, Raoult's and Henry's laws, activity coefficients, dilute solutions and alternate reference and standard states, interaction parameters, and reaction equilibrium involving components in solution. The course equips students with knowledge on the shifts in the Ellingham diagrams when activities of condensed phases and/or partial pressures of gases deviate from standard states. It applies the techniques of phase rule, phase equilibrium, and various types of phase diagrams, invariant reactions, solution thermodynamics and phase equilibrium relationships, and the deduction of simple phase diagrams from solution behaviour.

Course Code: CHMT3048A**Course Description: Process and Materials Design I****NQF Credits: 11****NQF Level: 7**

This course introduces students to key concepts of metallurgical process design and provides an overview of process design considerations, process design deliverables, constraints in design, basics of flowsheet development, basics of project management, how to write a design report, and examples of basic reactor models i.e. continuous stirred tank reactors (CSTR) and plug flow reactors (PFR). Process design of specific unit operations is also undertaken. Application of simulation packages like Modsim, Pyrosim and Matlab in calculations are mandatory.

Course Code: CHMT3049A**Course Description: Process and Materials Design II****NQF Credits: 11****NQF Level: 7**

This course is made up of three components.

The first component deals with two hydrometallurgical unit process design projects.

The second component requires students to undertake a project of a multi-disciplinary nature which equips them with skills to work across multidisciplinary boundaries.

The third component deals with basic principles of performing an economic evaluation of simple metallurgical facility, the project requires students to do equipment selection, sizing, costing and calculation of discounted cash flow (DCF), net present value (NPV) and internal rate of return (IRR).

Course Code: CHMT3050A

Course Description: Ore Dressing and Extractive Metallurgy (Mining)

NQF Credits: 10

NQF Level: 7

(10) (4-0-0) (1 term)

The course introduces mining engineering and geology students to the basic principles and unit operations used in the recovery, processing and refining of minerals and metals from ores. The following broad themes are covered: ore dressing, coal preparation, hydrometallurgy and pyrometallurgy. The course enables students to articulate a variety of principles and equipment used in association with ore dressing and extractive metallurgy; perform simple calculations; and pronounce the impact of processing on the environment and society.

Course Code: CHMT4000A

Course Description: Hydrometallurgy

NQF Credits: 9

NQF Level: 8

(9) (2-1-0) (1 term)

This course introduces the key concepts and techniques applied in the aqueous processing of minerals for metal recovery. Topics include thermodynamic (Pourbaix diagrams) and kinetic aspects of leaching; purification of leach liquor by solvent extraction and chemical precipitation processes; recovery of metal values by cementation and hydrogen gas reduction and electrowinning and refining from aqueous solutions and several industrial processes including copper, zinc, and gold processing are studied.

Course Code: CHMT4002A

Course Description: Physical Chemistry of Iron and Steel Manufacturing

NQF Credits: 12

NQF Level: 8

(12) (3-1-0) (1 term)

This course focuses on the physico-chemical aspects of ferrous production metallurgy. Students are required to apply fundamental and specialist knowledge on the interrelations between mass and energy balances, thermodynamics, phase equilibria, kinetic, transport phenomena and environmental issues while using relevant tools for modelling and simulation purposes to solve actual and complex engineering problems especially related to ferrous production metallurgy, instrumental in understanding Computational Process Dynamics.

Course Code: CHMT4003A

Course Description: Metallurgical Design

NQF Credits: 30

NQF Level: 8

(30) (1-0-8) (2 terms)

This course focuses on the role of ore characteristics in developing a process design, the ability to review different processes/alternative flowsheets, to provide rationale and motivation for selected flowsheet and to evaluate alternative process options on the basis of environmental impact, risk and profitability using computer based simulation and techno-economic analysis. It enables students to identify batch experimental data required for estimation of model parameters and to assess the scale up criteria for estimated model parameters and develops competence in performing material and energy balances and sizing of equipment using appropriate thermodynamic and kinetic models. An economic analysis of the process must be compiled in a report using an accepted structure, style and graphical support.

Course Code: CHMT4004A**Course Description: Research Project****NQF Credits: 30****NQF Level: 8****(30) (1-0-8) (2 terms)**

In this course students must investigate a specific research topic, usually bringing together many aspects of knowledge and understanding gained during the previous three years of study. Topics of interest are proposed by academics or in some cases by students after consultation with academics, and students are given an opportunity to select projects closest to their own interests. The projects may be laboratory, pilot plant or computer based (computer modelling, data collection and assessment) and must be presented as a submitted research proposal, literature review report, oral and poster presentation and a draft journal paper.

Course Code: CHMT4005A**Course Description: Management for Process Engineers****NQF Credits: 12****NQF Level: 8****(12) (3-1-0) (1 term)**

This course provides students entering industry with an overview of the non-technical areas that are key to business in the chemical, process and materials industries. It consists of three general management topics namely, projects management, financial management and operations management and focuses on the key concepts of professionalism and ethics, and its application to ethical engineering case studies.

Course Code: CHMT4006A**Course Description: Solid Fluid Systems****NQF Credits: 9****NQF Level: 8****(9) (2-1-0) (1 term)**

This course introduces students to the key concepts applicable to solid fluid systems. It focuses on particle characterisation (quantitative particle size distributions; effects of particle shape, composition and surface properties); behaviour of particles in fluids (settling velocities, drag forces as functions of particle and fluid properties); slurry rheology – (significance, modelling and prediction); pressure drop in packed beds; and the application of these principles to the modelling, analysis, design, and optimisation of industrial processes.

Course Code: CHMT4008A**Course Description: Particulate Systems****NQF Credits: 12****NQF Level: 8****(12) (3-1-1) (1 term)**

This course introduces students to the nature and behaviour of particulate solids and its influence on processing techniques in minerals beneficiation and extraction metallurgy. Topics include: solid-fluid interactions, describing the way particles move through fluids or fluids move through particulate solids; minerals liberation and the factors that govern the extent to which minerals in an ore can be liberated as well as the means and equipment used to achieve liberation; and minerals separations considering the principles of separating particles on the basis of their properties such as size, grade, relative density, shape, appearance and magnetic or electrical properties.

Course Code: CHMT4009A**Course Description: Chemical Engineering Design****NQF Credits: 30****NQF Level: 8**

(30) (1-0-8) (2 terms)

The course introduces students to the development of process flowsheet for a complete full chemical plant design and to compare it with alternatives. It equips students with the skill for detail design of a chemical reactor and a major piece of equipment while other items are approximately sized for costing purposes. Students must assess the social, legal, health, safety and environmental impacts of the design and complete an economic analysis of the process in a detailed report compiled using an accepted structure, style and graphical support.

Course Code: CHMT4011A

Course Description: Process Control

NQF Credits: 12

NQF Level: 8

(12) (2-1-1) (1 term)

This course focuses on control objectives (stability, optimisation and safety) and methodology for control system design; industry-wide conventions and terminology for effective multidisciplinary communication; mathematical modelling of processes; block diagrams; stability criteria, feedback controller design for Single Input Single Output (SISO) systems; extensions to multivariable systems; cascade, feedforward model-based and other specialised control systems and digital simulation of dynamic systems.

Course Code: CHMT4015A

Course Description: Welding and Forming Processes

NQF Credits: 9

NQF Level: 8

(9) (2-1-0) (1 term)

In this course topics covered include: casting as a forming process; gating and feeding systems; metal fluidity; continuous casting; design of castings; casting defects; important casting processes; mechanical forming of materials; hot and cold forming; formability; wire drawing; extrusion; rolling. deep drawing; forging; defects in wrought metals; welding processes; control and practical applications; pool interactions; residual stresses; weld metallurgy; weld defects and designing against failure.

Course Code: CHMT4017A

Course Description: Structure and Properties of Engineering Materials

NQF Credits: 12

NQF Level: 8

(12) (3-1-0) (1 term)

This course reviews how a material's structure determines its properties, and hence its applications. The course comprises of four components: power metallurgy – manufacturing of the powders processing of the powders and applications; solid state transformations including solid state nucleation, grain growth, and the contribution of diffusion; ternary phase equilibria and how to represent materials and reactions in graphic format; and structures and properties of non metallic materials as related to physical and mechanical properties.

Course Code: CHMT4019A

Course Description: Chemical Engineering Research Project

NQF Credits: 30

NQF Level: 8

(30) (1-0-8) (2 terms)

In this course students must investigate a specific research topic, usually bringing together many aspects of knowledge and understanding gained during the previous three years of study. Topics of interest are proposed by academic or in some cases by students after consultation with academics, and students are given an opportunity to select projects closest to their own interests. The projects may be laboratory, pilot plant or computer based (computer modelling, data collection and assessment) and must be presented as a submitted research proposal, literature review report, oral and poster presentation and a draft journal paper.

Course Code: CHMT4020A**Course Description: Hydrometallurgical Processes****NQF Credits: 12****NQF Level: 8****(12) (2-1-1) (1 term)**

This course introduces the students to the key concepts and techniques applied in the aqueous processing of minerals for metal recovery. Topics include thermodynamic (Pourbaix diagrams) and kinetic aspects of leaching; purification of leach liquors by solvent extraction and chemical precipitation processes; recovery of metal values by cementation and hydrogen gas reduction and electrowinning and refining from aqueous solutions, several industrial processes including copper, zinc, and gold processing are studied and the application of hydrometallurgical concepts through laboratory work.

Course Code: CHMT4029A**Course Description: Biochemical Engineering****NQF Credits: 9****NQF Level: 8****(9) (2-1-0) (1 term)**

This course introduces students to key concepts of biochemical engineering and covers basic aspects of microbiology and biochemistry. The main focus of the course, however, is the application of chemical engineering principles to industrial biological production processes. Topics covered in the course include bioreactor design and scale up, bioreactor configuration, heat and mass transfer issues and industrial uses of bioprocesses.

Course Code: CHMT4030A**Course Description: Fundamentals of Pyrometallurgy****NQF Credits: 9****NQF Level: 8****(9) (2-1-0)**

This course provides students with an understanding of the fundamental principles of pyrometallurgy. It focuses on the physical chemistry processes at work during high temperature production of metals and alloys, and covers topics such as principles of pyrometallurgy, solid state pyrometallurgy, liquid state pyrometallurgy, the physical chemistry of iron and steel manufacturing, base metal smelting, and the impact of pyrometallurgical processes on the environment and society.

Course Code: CHMT4031A**Course Description: Fundamentals of Mineral Processing****NQF Credits: 9****NQF Level: 8****(9) (2-1-0)**

This course covers the unit processes involved in mineral beneficiation, including mathematical analysis and description of size distributions; evaluation of liberation, grade and recovery; modelling of milling capacity based on Bond theory and milling kinetics theory; classification theory; gravity separation methods; flotation chemistry, machinery and circuits; flotation kinetics as well as dewatering and filtration.

Course Code: CHMT4032A**Course Description: Advanced Chemical Reaction Engineering****NQF Credits: 9****NQF Level: 8****(9) (2-1-0)**

In this course the design, analysis and synthesis of chemical reactor networks is described. Problems and complexities associated with arranging multiple chemical reactors that work in unison for a prescribed duty are first described, followed by a review of contemporary state-of-the-art methods for their solution.

Mathematical tools and techniques from calculus and elementary linear algebra are then developed, which assist in analysing and solving the reactor network synthesis problem. These methods may involve the development and use of novel geometric and computer-based methods. Analysis and modeling of the system is carried out using these methods, resulting in suitable alternatives being developed. The proposed alternatives are then evaluated in terms of their economic and practical suitability against commonplace engineering methodologies which informs an overall recommendation.

Course Code: CHMT4033A

Course Description: Wastewater Engineering

NQF Credits: 9

NQF Level: 8

(9) (2-1-0)

This course introduces students to the concepts of wastewater treatment as a consequence of increased urban, industrial and agricultural growth. Special topics such as Water Accounting/Footprinting may also be covered.

Course Code: CHMT4034A

Course Description: Synthetic Fuels

NQF Credits: 9

NQF Level: 8

(9) (2-1-0)

In this course, techniques are developed for clean fuel, chemicals and power production. The course covers synthetic fuel routes, direct and indirect liquefaction, gasifier reactor modelling, pyrolysis, Fischer-Tropsch and methanol synthesis, natural gas and syngas production.

Course Code: CHMT5000A

Course Description: Introduction to Extractive Metallurgy

NQF Credits: 20

NQF Level: 8

This course introduces the principles of physical, hydrochemical, electrochemical and thermochemical processing; unit operations; ore mineralogy; size reduction and classification; particle separation; stoichiometric and mass balance calculations; chemical equilibria; aqueous processing; smelting and refining.

Course Code: CHMT5001A

Course Description: Metallurgical Process Modelling & Design

NQF Credits: 20

NQF Level: 8

This course covers the fundamentals of specific metallurgical unit processes covering topics such as brainstorming, costing, and specification, professional ethics, material selection, occupational health and safety legislation and elementary principles of engineering drawing and flowsheet construction which will be presented verbally in mini-design project(s).

Course Code: CHMT5002A

Course Description: Extractive Metallurgy Investigative Project

NQF Credits: 20

NQF Level: 8

In this course students are allocated an investigative research project that they must complete, emanating either from industry or as proposed by an academic supervisor(s).

Course Code: CHMT5003A

Course Description: Principles of Hydrometallurgy

NQF Credits: 20

NQF Level: 8

This course focuses on the behaviour of metal ions in solution (chemical and redox equilibria), thermodynamics of leaching processes - Eh vs pH diagrams, leaching methods and systems, particulate leaching models and kinetics, chemical and reductive precipitation processes, solvent extraction and carbon adsorption processes electro recovery processes (electrorefining and electrowinning).

Course Code: CHMT5004A

Course Description: Principles of Mineral Processing

NQF Credits: 20

NQF Level: 8

This course focuses on mathematical analysis and description of size distributions, evaluation of liberation, grade and recovery, modelling of milling capacity based on bond theory and milling kinetics theory, classification theory, gravity separation methods, flotation chemistry, machinery and circuits, flotation kinetics and Dewatering and waste disposal.

Course Code: CHMT5005A

Course Description: Principles of Pyrometallurgy

NQF Credits: 20

NQF Level: 8

This course focuses on the fundamental knowledge of physical chemistry applicable to various high temperature processes encountered in the production of metals and alloys and includes unit processes such as principles of pyrometallurgy, solid state pyrometallurgy, liquid state pyrometallurgy, gaseous state pyrometallurgy, the production of iron and steel, ferroalloys and base metals and the impact of pyrometallurgy on society and environment.

Course Code: CHMT5006A

Course Description: Introduction to Petroleum and Offshore

NQF Credits: 20

NQF Level: 8

This course introduces candidates to the units and practices of exploration, production and refining of petroleum and petrochemicals, the design of petroleum drilling and production platforms and the ability to determine material specifications for offshore structures, riser and facility installation.

Course Code: CHMT5007A

Course Description: Petroleum Reservoir and Production Engineering

NQF Credits: 20

NQF Level: 8

The course focuses on petroleum production systems including reservoir's inflow performance and well's outflow performance concepts, formation damage mechanisms, and nodal analysis, the design of artificial lift systems including associated technologies, equipment and fundamental mechanisms. Candidates are required to show and apply knowledge in basic concepts of reservoir engineering in oil products engineering and rock properties in oil and gas production, and perform thermodynamics analysis of hydrocarbon recovery in porous media.

Course Code: CHMT5008A

Course Description: Drilling and Completion Engineering with Laboratory

NQF Credits: 20

NQF Level: 8

This course provides candidates with the knowledge of drilling and completion engineering in oil and gas industry required to apply design mud and cement slurry for mudding and cementing operations for drilling/completion operation. Topics include new developing technology of drilling and completion engineering relevant to oil and gas operations, a general overview of the fundamental aspects of drilling engineering (mud design, cementing, rotary drilling rig systems, drillstring design, introduction to hydraulics, flow in pipes, annuli and drilling bits), and the measurement of rheological properties of drilling fluids and cement, such as, viscosity, gel strength and yield point, and drilling simulator.

Course Code: CHMT5009A**Course Description: Risk Management and Sustainable Development in Oil & Gas Engineering****NQF Credits: 20****NQF Level: 8**

This course focuses on risk management, accident sources, consequences and preventative action in industry. Topics include personnel health and safety, loss prevention and control and process safety analysis in petroleum industry and sustainable development combining economic development, social advancement, environmental protection widely recognised by the public, private and civic sectors as one of the key challenges for the 21st century.

Course Code: CHMT5010A**Course Description: Natural Gas Production and Oilfield Processing****NQF Credits: 20****NQF Level: 8**

The course has two components:

- 1) The first component focuses on properties of natural gases, and topics include: natural gas processing and treatment; liquid recovery, dehydration and sweetening; removal of water and acid gases; hydrogen sulfide conversion; temperature distribution in pipes; natural gas hydrates and hydrate prevention methods; oil and gas separators; oil absorption and stripping; condensate removal; natural gas liquefaction; process design; heat exchangers, heaters, cooling methods; pumps and compressors; measuring devices, health and safety equipment.
- 2) The second component focuses on oilfield processing and topics include: measurement and instrumentation; relief systems and storage; multiphase flow calculations in pipelines; separator design and sizing of flow lines; pumps and hydraulic turbines; hydrate formation and remedial options; hydrocarbon recovery; utilities in upstream processing; dehydration and hydrocarbon treating; compressors, expanders and refrigerators.

Course Code: CHMT5011A**Course Description: Oil and Gas Engineering Project****NQF Credits: 20****NQF Level: 8**

This course focuses on process design and optimisation, process evaluation and selection, site location, plant layout and process flowsheet and piping diagram, environmental impact assessment and legislation on petroleum production. Candidates are required to investigate aspects of chemical, petroleum, petrochemical, oil and gas engineering process or plant using appropriate research methods via assigned projects.

Course Code: CHMT5012A**Course Description: Vacation/Industrial Training (Oil & Gas Engineering)****NQF Credits: 20****NQF Level: 8**

In this course, candidates are assigned a project investigating aspects of a chemical, petroleum and petrochemical engineering processes or plant using appropriate research methods and to undertake experiential training in an oil and gas industry environment.

Course Code: CHMT5013A**Course Description: Design and Construction of Welded Structures under Static Loading****NQF Credits: 20****NQF Level: 8**

This course focuses on basic theory of structural systems, fundamentals of the strength of materials, basics of weld design, design principles of welded structures, joint design for welding and brazing, basics of weld design, behaviour of welded structures under different types of loading and design of welded structure with predominantly static loading

Course Code: CHMT5014A**Course Description: Design and Construction of Welded Structures under Dynamic Loading****NQF Credits: 20****NQF Level: 8**

This course focuses on behaviour of welded structures under cyclic (dynamic) loading. The candidates is given the tools to do the following; determination of load, design of cyclic loaded welded structures, design of welded pressure equipment, design of structures of aluminium alloys and an introduction to fracture mechanics.

Course Code: CHMT5015A**Course Description: Practical Education Welding and Fabrication Processes****NQF Credits: 20****NQF Level: 8**

In this course the engineering of welding is introduced. The candidate is given practical exposure to structural welding practice guided by experts. Candidates are introduced to realities of structural welding so theory can be understood in context. The candidate is also exposed to the University library system, guided by library staff to assist structured report writing.

Course Code: CHMT5016A**Course Description: Fabrication Applications Engineering****NQF Credits: 20****NQF Level: 8**

This course provides the candidate with an introduction to quality assurance in welded fabrication, quality control during manufacture, residual stresses and distortion, plant facilities, welding jigs and fixtures, imperfections and acceptance criteria, repair welding and reinforcing steel welded joints.

Course Code: CHMT5017A**Course Description: Non-Destructive Testing Methods and Economics****NQF Credits: 20****NQF Level: 8**

This course introduces the candidate to two main aspects: non-destructive testing of welded structures, and economics of welding (which includes productivity, health and safety, measurement, control, and recording in welding).

Course Code: CHMT5018A**Course Description: Case Studies for Welding Engineers****NQF Credits: 20****NQF Level: 8**

This course focuses case studies of failures involving welds and joints in steel and lightweight structures, boilers and pressure vessels, chemical plants and pipelines, shipbuilding and offshore applications transportation (automobiles, railways) and aerospace applications. The candidate is provided with the methodology and practice of performing case studies.

Course Code: CHMT5019A**Course Description: Welding Metallurgy of Steels****NQF Credits: 20****NQF Level: 8**

This course focuses on structure and properties of pure metals, alloys and phase diagrams, iron carbon alloys, manufacture and cracking phenomena in welding, fractures and different kinds of fractures, heat treatment of base metals and the welded joint, structural (unalloyed) steels designation of steels and behaviour of structural steels in fusion welding.

Course Code: CHMT5020A**Course Description: Weldability of Alloy Steels and Stainless Steels****NQF Credits: 20****NQF Level: 8**

This course focuses on high strength steels, application of structural and high strength steels, low alloy creep resistant steels alloy, steels for very low temperature applications, introduction to corrosion and stainless and heat resistant steels.

Course Code: CHMT5021A

Course Description: Weldability of Ferrous and Non-Ferrous Materials

NQF Credits: 20

NQF Level: 8

This course focuses in an introduction to wear and protective layers, cast irons and steels, copper and copper alloys, nickel and nickel alloys, aluminium and aluminium alloys, other metals and alloys, joining dissimilar materials, metallographic investigations and destructive testing.

Course Code: CHMT5022A

Course Description: Welding Processes and Equipment

NQF Credits: 20

NQF Level: 8

This course gives an introduction to welding technology. It provides the candidate with the theory and practice of oxy-gas welding and related processes, electro-technics, the arc, and power sources for arc welding. The techniques of gas-shielded arc welding, TIG welding, MIG/MAG and flux cored welding; MMA (manual metal arc welding) and submerged arc welding are introduced.

Course Code: CHMT5023A

Course Description: Other Welding Processes

NQF Credits: 20

NQF Level: 8

This course provides the candidate with details of other, less common welding processes and related material treatment. The candidate will gain an understanding of resistance welding, laser, electron beam and plasma, other welding processes, cutting, drilling and other edge preparation processes, surfacing and spraying, fully mechanised processes and robotics.

Course Code: CHMT5024A

Course Description: Advanced Welding Processes

NQF Credits: 20

NQF Level: 8

This course focuses on advanced welding processes, such as brazing and soldering, joining processes for plastics, joining processes for ceramics and composites. The candidate is guided by skilled welding teachers in practical training on oxy acetylene welding and cutting, MMA, TIG, and MIG/MAG. The candidate is also familiarised with welding laboratory tests (including bend tests) and difficulties and typical defects associated with incorrect use of the different welding methods.

Course Code: CHMT5025A

Course Description: Process Fundamentals A

NQF Credits: 20

NQF Level: 8

This course introduces key concepts in process engineering and topics include industrial process calculations, including basic design, process flow sheeting, dimension and dimensionless analysis, and material and energy balances. It enables candidates to perform basic calculations around different reactor types and apply thermodynamic concepts to engineering problems.

Course Code: CHMT5026A

Course Description: Process Fundamentals B

NQF Credits: 20

NQF Level: 8

This course expands on 'Process Fundamentals A', by furthering the candidate's understanding of process engineering. It enables candidates to perform calculations around transport phenomena problems in chemical engineering (including mass transfer, heat transfer and momentum transfer and fluid flow), design basic processes (including equipment selection and costing) and introduces industrial safety in the process environment.

Course Code: CHMT5027A**Course Description: Biochemical Engineering with Industrial Applications****NQF Credits: 20****NQF Level: 8**

This course equips candidates with an understanding of the basic concepts involved in biochemical engineering and industrial applications of biochemical processes. It is made up of two components basics of biochemical engineering and industrial applications. Basics of biochemical engineering focuses on introduction to microbiology, DNA and cell physiology, enzyme kinetics, metabolic pathways, thermodynamics of metabolism, aerobic and anaerobic metabolism, stoichiometry of cell growth, modelling of batch, fed batch and continuous reactors, operating systems, process control and scale-up factors for bioprocesses, product recovery and purification, food process hygiene and kinetics of cell death and genetic manipulation of organisms. Industrial applications focus on uses of bioprocesses such as waste water treatment, detailing how and why bio-processes are used and prospects for future developments.

Course Code: CHMT5028A**Course Description: Risk Management and Sustainable Development in Chemical Engineering****NQF Credits: 20****NQF Level: 8**

This course provides knowledge on risk management, accident sources, consequences and preventative action in the chemical industry. It introduces candidates to personnel health and safety, loss prevention and control, and process safety analysis in the chemical industry and provides knowledge on sustainable development that combines economic development, social advancement, and environmental protection that is widely recognised by the public, private and civic sectors as one of the key challenges for the 21st century.

Course Code: CHMT5029A**Course Description: Chemical Engineering Investigational Project A****NQF Credits: 20****NQF Level: 8**

This course equips candidates with the necessary skills to successfully design their research. Additionally, it instills an understanding of the underlying principles of postgraduate research from an engineering perspective. The methods taught in this course equip them with the knowledge needed to design, plan and construct their own research process. Candidates are expected to write a research proposal with literature review on a research topic closest to their own interests proposed by academics, or in some cases by candidates after consultation with academics.

Course Code: CHMT5030A**Course Description: Chemical Engineering Investigational Project B****NQF Credits: 20****NQF Level: 8**

In this course candidates are required to investigate a specific research topic as proposed in Investigational Project A bringing together aspects of knowledge and understanding gained in the PGDip in Engineering in the field of Chemical Engineering. The projects may be laboratory, pilot plant or computer based (computer modelling, data collection and assessment) and must be presented through an oral and poster presentation and a draft journal paper.

Course Code: CHMT7005A**Course Description: Coal Sampling and Quality Assessment****NQF Credits: 20****NQF Level: 9**

This course introduces candidates to key concepts in coal sampling and quality assessment. The course covers principles and practice of sampling (major sources of error with statistical basis of sampling; methods of sampling; economic impact of correct and incorrect sampling); principles of coal analysis calculation to different bases; applications to production, beneficiation, transport, storage, utilisation and environmental issues; and principles of integrated assessment, substitution, specification & classification.

Course Code: CHMT7006A**Course Description: Coal Management and Marketing****NQF Credits: 20****NQF Level: 9**

This course focuses on the chain of impact between exploration, exploitation, beneficiation, production, marketing and utilisation; primary, secondary and tertiary product manufactures and use, energy and environment. It also focuses on trade and marketing principles; techno-economic trends in supply and demand in domestic and world markets, negotiation supply and agreements, coal quality management, shipping economics and methodology, inland transport, port/terminal operations and contractual legalities.

Course Code: CHMT7011A**Course Description: Physiochemical Principles of Refractory Use****NQF Credits: 20****NQF Level: 9**

In this course important characteristics and the environment of refractory is reviewed. Topics include principles of the use of multicomponent phase diagrams, liquidus/solidus projections, isothermal/vertical sections, paths of melting/crystallisation, recurrent crystallisation, refractory attack, reaction between phases: metal-refractory, gas-refractory, slag-refractory, silica as a refractory, alumina-silica system, chrome refractories, basic refractories, carbon and special refractories and refractory selection.

Course Code: CHMT7012A**Course Description: Advanced Design of Structural Steel****NQF Credits: 20****NQF Level: 9**

This course covers several advanced topics in Design of Steel Structures. Its purpose is to give a broad understanding of the topics covered as well as in depth understanding to the design procedures. The course is limited to steel structures subject to static loading.

Material covered: Introduction; Design of Industrial Buildings; Design of Composite Buildings; Design of Structural Steel Connections.

Course Code: CHMT7013A**Course Description: Solid, Liquid and Gaseous State Pyrometallurgical Processes****NQF Credits: 20****NQF Level: 9**

This course focuses on principles of pyrometallurgy, high temperature technology, solid state pyrometallurgy, drying and calcinations, roasting and sinter-roasting and sinter-roasting, pre-reduction and direct reduction, liquid state pyrometallurgy, principles and equipment, extraction and refining processes, molten salt electrolysis, casting, gaseous state pyrometallurgy, principles, vapour metallurgy, halide metallurgy and metal extraction routes.

Course Code: CHMT7014A**Course Description: Kinetics and Transport Phenomena in Pyrometallurgy****NQF Credits: 20****NQF Level: 9**

This course focuses on chemical kinetics, activation energy, empirical and semi-empirical kinetics, chemically controlled reactions, nucleation and growth, non-ideal conditions and complex reactions, transport phenomena, engineering units, fluid flow; momentum transport and laminar flow, turbulent flow heat transport, conduction, convection, diffusion in the solid state, mass transport in fluids, rate processes in pyrometallurgy; gas-solid, gas-liquid, liquid-liquid reactions, kinetic modelling and case studies.

Course Code: CHMT7015A**Course Description: Thermodynamics and Phase Equilibria in Pyrometallurgy****NQF Credits: 20****NQF Level: 9**

This course reviews basic thermodynamics. Topics include solution thermodynamics, fundamentals of the thermodynamics of high temperature solutions, dilute solutions, alternative reference and standard states, interaction parameters, solution modelling, relationship between solution thermodynamics and phase diagrams, ternary/multicomponent phase diagrams, phase rule and phase reactions, alkamede theorem, equilibrium path of solidification, combination of thermodynamics and phase equilibria pertinent to pyrometallurgy and case studies.

Course Code: CHMT7016A

Course Description: Selected/Special Topics in Pyrometallurgy

NQF Credits: 20

NQF Level: 9

This course focuses on slags, their properties and role in high temperature processing, principles of sulphide smelting, principles of ferrous metallurgy, manufacture of ferroalloys, aluminium and magnesium, principles of electric furnace, operation and metallurgical implications, electric arc furnaces, DC furnaces and electric (slag) furnace processes.

Course Code: CHMT7018A

Course Description: Materials Characterisation

NQF Credits: 20

NQF Level: 9

In this course information needed to characterise each material is identified and the type of physical interactions and relevant techniques to be used are discussed. These may include electron microscopy, atomic force microscopy, x-ray diffraction, transmission electron microscopy, Raman scattering, nuclear magnetic resonance, mass spectroscopy and Rutherford backscattering). Materials selected include metals, insulators and semiconductors, polymers and polymer composites, ceramics, nanomaterials and ones with interesting surface properties, such as catalysts.

Course Code: CHMT7019A

Course Description: Advanced Materials Processing

NQF Credits: 20

NQF Level: 9

This course focuses on particulate processing, metals and non-metals; near net shape processes, sintered and not isostatic pressed products; hard metals, diamond and cubic Boron Nitride based products; ceramics, glasses and glass-ceramics; effect of fabrication processes on mechanical thermal and optical properties; polymers, thermoplastics and thermosets, additives; effect of fabrication processes on mechanical and optical properties; composites, metal ceramic and polymeric matrices; effect of fabrication processes on properties; semiconductors and their processing; magnetic materials and effect of fabrication process on properties; metallic and ceramic magnets.

Course Code: CHMT7020A

Course Description: Principles of Ceramic Processing

NQF Credits: 20

NQF Level: 9

In this course, the following topics are discussed review of principles of surface chemistry; ceramic raw materials, characteristics and specifications of ceramic materials, chemical and phase composition, particle size and shape, density, pore structure, specific surface area, processing additives, liquids and wetting agents, deflocculants and coagulants, flocculants, binders, plasticisers, foaming and antifoaming agents, particle mechanics theology, beneficiation processes, forming processes, drying, surface processing, surface finishing, film printing and glazing and firing processes.

Course Code: CHMT7022A

Course Description: Failure Analysis of Engineering Materials

NQF Credits: 20

NQF Level: 9

This course introduces fracture mechanical and stress concentration factors, the importance of performing failure analyses, evaluation of failures and main mechanisms of failure, importance of microstructure and design, fracture toughness, the mechanism of creep, fatigue failure, designing against fatigue, effect of welding, basic mechanisms of corrosion and wear with particular reference to preventing failure.

Course Code: CHMT7023A**Course Description: Transport Phenomena in Materials Processing****NQF Credits: 20****NQF Level:9**

This course reviews momentum transport and laminar flow, viscosities of liquid metals, equations of continuity and conservation, turbulent flow, applications to metal and materials processing, transport of heat by conduction and convection, solidification heat transfer, continuous casting, radiation heat transfer, furnace enclosures, mass transport by diffusion in the solid state, homogenisation of alloys, surface coatings, mass transport in fluid systems, simultaneous heat and mass transfer.

Course Code: CHMT7024A**Course Description: Structure and Properties of Engineering of Materials****NQF Credits: 20****NQF Level:9**

This course reviews crystal structure and banding, dislocation theory, plastic deformation, work hardening, strengthening by solid solution, coherent and incoherent particles, structure property relationships in metals and alloys, ceramics, polymers and composites, effects of solid state transformations, additives, interfaces, and composition on properties of materials, importance of matrix and fibre/particle properties on composites.

Course Code: CHMT7025A**Course Description: Electrical, Magnetic, Optical and Thermal Properties of Materials****NQF Credits: 20****NQF Level:9**

This course introduces wave mechanics of particles and the electron energy band theory in solids, conductivity of metals and semiconductors, effects of doping on the conductivity of semiconductors, dielectric properties, piezoelectricity, magnetic properties, superconductivity, optical properties, thermal properties, cohesion and elastic properties and applications of these properties.

Course Code: CHMT7027A**Course Description: Thermodynamics & Phase Equilibria of Materials****NQF Credits: 20****NQF Level:9**

This course reviews solution and modelling of thermodynamics, thermodynamics of solids, the relation between thermodynamic and physical properties, equilibrium between phases of variable composition, Thomsons-Freundlich equation, solubility of metastable phase, retrograde solubility, thermodynamics of interface and defects, the relationship between solution thermodynamics and phase diagrams, phase diagram microstructure relationships, principles of phase equilibria, one component systems - Clausius-Clapeyron, two and three component systems diagrams, alkameda theorem, systems without solid solutions and equilibrium path of crystallisation/melting.

Course Code: CHMT7028A**Course Description: Physical Processing of Ores****NQF Credits: 20****NQF Level:9**

This course focuses on particle characterisation, comminution theory, mathematical modelling of crushers and mills, classification process, solid-liquid separation, simulation and optimisation of circuits involving size reduction and classification.

Course Code: CHMT7029A**Course Description: Mineral Beneficiation****NQF Credits: 20****NQF Level:9**

This course focuses on flotation, surface chemistry, transport phenomena, modelling and design of equipment, magnetic and electrostatic separators, integrated mineral beneficiation circuits, simulation and optimisation and case studies.

Course Code: CHMT7030A**Course Description: Leaching Operations in Hydrometallurgy****NQF Credits: 20****NQF Level:9**

This course focuses on thermodynamics of aqueous solution and solution – mineral interfaces, formation of complexes, electrochemical theory of leaching, mass transfer controlled processes, kinetics and mechanisms of reactions involving particles, practical leaching systems, modelling, design and optimisation of processes.

Course Code: CHMT7031A**Course Description: Electrometallurgy****NQF Credits: 20****NQF Level:9**

This course focuses on ions in solution, electrode reactions and kinetics, mass transport at electrode surfaces, design of electrochemical experiments, modelling, optimisation and control, design and scale-up of cells and case studies.

Course Code: CHMT7032A**Course Description: Separation Processes in Hydrometallurgy****NQF Credits: 20****NQF Level:9**

This course focuses on precipitation nucleation and growth of a new phase, mixing of suspensions, scale up criteria, batch and continuous processes, ion exchange, solvent extraction and carbon adsorption, kinetics and equilibria, experimental methods, modelling, design and optimisation of industrial processes.

Course Code: CHMT7035A**Course Description: Process Flowsheet Synthesis****NQF Credits: 20****NQF Level:9**

The aim of this course is to exploit innovations and explore the opportunities and alternatives that normally occur at the early stages of the project and to demonstrate the consequence of these early decisions on the subsequent development of the process as detailed design is undertaken.

Course Code: CHMT7036A**Course Description: Finite Element Analysis of Structures****NQF Credits: 20****NQF Level:9**

This course is an introduction to the finite element method (FEM). Its purpose is to give a broad understanding of finite elements and the method's use. The course is limited to linear, elastic and small deformation theory.

Material covered: Introduction: Matrix Methods; Principle of virtual work, The Finite Element Method derived; Beam elements revisited, Isoparametric Finite Elements; Classes and types of elements, Pascal's triangle, Convergence; Numerical Implementation: Gauss integration, Jacobian, Accuracy, Derivation of beam elements from 2D isoparametric elements; Locking

Special topics: Numerical solution (Gauss Elimination, Skyline; Iterative methods; Gauss-Seidel); Symmetry; Stiff Elements; Aspect ratio

Course Code: CHMT7037A**Course Description: Distillation Synthesis****NQF Credits: 20****NQF Level:9**

This course which focuses on the implications of distillation synthesis for industrially applicable problems reviews the development of a new approach to distillation. Topics include sessions during which distillation synthesis is applied to practical problems, and an intuitive understanding of how thermodynamics affects distillation column design and distillation column sequencing.

Course Code: CHMT7038A**Course Description: Applied Thermodynamics****NQF Credits: 20****NQF Level:9**

In this course graduate scientists and engineers are able to experience thermodynamics in the use of modern simulation software enabling a definite understanding of the role played by the system on a thermodynamic level in the understanding of the subject on a more practical and in depth level.

Course Code: CHMT7039A**Course Description: Applied Optimisation Methods****NQF Credits: 20****NQF Level:9**

The course covers optimization methods and its application in problem analysis. Topics include, function minimization (1D, 2D; 3D and nD; Newton-Raphson); constrained problems (formulation and solving using excel); linear programming (non-integer, integer and sensitivity analysis); model fitting and parameter estimation; trajectory optimization, calculus of variations, dynamic, pontryagin and attainable regions programming; neural networks; genetic algorithms; and pattern search.

Course Code: CHMT7040A**Course Description: Experimental Process Synthesis****NQF Credits: 20****NQF Level:9**

The course aims to bridge the communication gap between chemists and chemical engineers, working side by side in industry. The course covers thermodynamic fundamentals, analysis and modelling of experimental data and the interaction of these aspects with process flowsheet design.

Course Code: CHMT7043A**Course Description: Welding Processes and Equipment****NQF Credits: 20****NQF Level:9**

This course gives an introduction to welding technology. It provides the candidate with the theory and practice of oxy-gas welding and related processes, electro-technics, the arc, and power sources for arc welding. The techniques of gas-shielded arc welding, TIG welding, MIG/MAG and flux cored welding, MMA (manual metal arc welding) and submerged arc welding are introduced.

Course Code: CHMT7044A**Course Description: Other Welding Processes****NQF Credits: 20****NQF Level:9**

This course provides the candidate with details of other, less common welding processes and related material treatment. The candidate will gain an understanding of resistance welding, laser, electron beam and plasma, other welding processes, cutting, drilling and other edge preparation processes, surfacing and spraying, fully mechanised processes and robotics.

Course Code: CHMT7045**Course Description: Advanced Welding Processes****NQF Credits: 20****NQF Level:9**

This course focuses on advanced welding processes, such as brazing and soldering, joining processes for plastics, joining processes for ceramics and composites. The candidate is guided by skilled welding teachers in practical training on oxy acetylene welding and cutting, MMA, TIG, and MIG/MAG. The candidate is also familiarised with welding laboratory tests (including bend tests) and difficulties and typical defects associated with incorrect use of the different welding methods

Course Code: CHMT7046A**Course Description: Fabrication, Applications Engineering****NQF Credits: 20****NQF Level:9**

This course provides the candidate with an introduction to quality assurance in welded fabrication, quality control during manufacture, residual stresses and distortion, plant facilities, welding jigs and fixtures, imperfections and acceptance criteria, repair welding and reinforcing steel welded joints.

Course Code: CHMT7047A

Course Description: Non-Destructive Testing Methods and Economics

NQF Credits: 20

NQF Level: 9

This course introduces the candidate to two main aspects: non-destructive testing of welded structures, and economics of welding (which includes productivity, health and safety, measurement, control, and recording in welding).

Course Code: CHMT7049A

Course Description: Welding Metallurgy of Steels

NQF Credits: 20

NQF Level: 9

This course focuses on structure and properties of pure metals, alloys and phase diagrams, iron carbon alloys, manufacture and designation of steels, behaviour of structural steels in fusion welding, cracking phenomena in welding, fractures and different kinds of fractures, heat treatment of base metals and the welded joint and structural (unalloyed) steels.

Course Code: CHMT7050A

Course Description: Weldability of Alloy Steels and Stainless Steels

NQF Credits: 20

NQF Level: 9

This course focuses on high strength steels, application of structural and high strength steels, low alloy creep resistant steels, low alloy steels for very low temperature applications, an introduction to corrosion and stainless and heat resistant steels.

Course Code: CHMT7051A

Course Description: Weldability of Ferrous and Non Ferrous Materials

NQF Credits: 20

NQF Credits: 9

This course focuses on an introduction to wear and protective layers, cast irons and steels, copper and copper alloys, nickel and nickel alloys, aluminium and aluminium alloys, other metals and alloys, joining dissimilar materials and metallographic investigations/ destructive testing.

Course Code: CHMT7052A

Course Description: Case Studies for Welding Engineers

NQF Credits: 20

NQF Level: 9

This course focuses on case studies of failures involving welds and joints in steel and lightweight structures, boilers and pressure vessels, chemical plants and pipelines, shipbuilding and offshore applications transportation (automobiles, railways) and aerospace applications. The candidate is provided with the methodology and practice of performing case studies.

Course Code: CHMT7053A

Course Description: Practical Education welding and fabrication processes

NQF Credits: 20

NQF Level: 9

In this course, the engineering of welding is introduced. The candidate is given practical exposure through site visits to structural welding practice guided by experts. Candidates are introduced to realities of structural welding so theory can be understood in context. The candidate is also exposed to the University library system, guided by library staff to assist structured report writing.

Course Code: CHMT7055A**Course Description: Nanotechnology****NQF Credits: 20****NQF Level: 9**

This course focuses on nanotechnology as a relatively new technology where the ability to systematically organise and manipulate properties and behaviour of matter and build matter at the atomic and molecular level- is studied.

Course Code: CHMT7057A**Course Description: Coal Combustion and Power Generation****NQF Credits: 20****NQF Level: 9**

This course focuses on principles of combustion, combustion calculations, industrial combustion technologies, chain grate, underfeed and spreader stokers, shell and water-tube boilers, fluidised bed combustion, power generation by pulverised fuel injection, economic and technical impact of coal quality on industrial combustion and power generation performance, NO_x, SO_x, and CO₂ production, by-product management, economics, energy auditing, future technologies and alternative sources of energy.

Course Code: CHMT7058A**Course Description: Coal Preparation and Beneficiation****NQF Credits: 20****NQF Level: 9**

This course provides the candidate with an in-depth look at coal preparation and beneficiation processes. The course covers the following topics: South African coal reserves, markets and exports; basis of beneficiation, applications and limitations of density-based processes; concepts of washability and plant efficiency; dependant and independent criteria of assessment of performance; surface dependant processes; novel beneficiation techniques; and ancillary operation and plant design.

Course Code: CHMT7059A**Course Description: Coal Conversion and Gasification****NQF Credits: 20****NQF Level: 9**

This course focuses on coal conversion and gasification. The course covers the following topics: principles of gasification, liquefaction/solvent extraction and metallurgical processes; process and plant technologies; coke, char and carbon; factors influencing carbon reactivity; influence of minerals and inorganic elements on powder process technologies; environmental issues; and economic impact studies.

Course Code: CHMT7060A**Course Description: Coal and Carbon in the Metallurgical Industry****NQF Credits: 20****NQF Level: 9**

This course focuses on the use of carbon and coal in metallurgical industries. Topics include: introduction to thermodynamics and phase equilibria pyrometallurgy; carbon feedstocks in pyrometallurgical processes; origin, formation and production of each carbon type; principles and properties including reactivity, resistivity, strength, hardness, porosity and surface area; carbon-metal chemistry and reaction kinetics; transport phenomena; ferroalloy production and iron and steel making; and trends in pyrometallurgical processes in relation to future carbon feedstocks and additional uses of coal/carbon in metal processing.

Course Code: CHMT7062A**Course Description: The Future of the Automotive Industry and Fuels****NQF Credits: 20****NQF Level: 9**

This course explores the future of the automotive industry and fuels. It focuses on the following topics such as challenges facing the world, the evolution of the automotive industry and automotive fuels, as well as, the future of automotive fuels.

Course Code: CHMT7063A**Course Description: Process Instrumentation and Control in Refining****NQF Credits: 20****NQF Level: 9**

This course introduces the candidate to key concepts around process instrumentation and control in refining. The course covers the following topics: an introduction to refining; digital control systems; quality soft sensors and possible controllers; instrumentation of a distillation column; and the role of the engineer in process instrumentation and control in refining.

Course Code: CHMT7064A**Course Description: Introduction to Oil and Gas Production Corrosion Mechanism****NQF Credits: 20****NQF Level: 9**

This course introduces the candidate to corrosion in oil and gas production. The course focuses on topics such as: internal metal loss corrosion; hydrogen embrittlement; control of corrosion; monitoring of corrosion; external corrosion; and control of external corrosion.

Course Code: CHMT7065A**Course Description: Oil Products and Refining Water Resource Planning****NQF Credits: 20****NQF Level: 9**

This course describes the issues involved in planning, designing and operating water resource systems and the modelling approaches and methods applied for this.

It covers the following:

1. An Overview of Water Resources Planning and Management:
2. The role of Water Resource Systems Modelling in Planning and Management
3. Modelling Methods for Evaluating Alternatives
4. Simulation
5. Optimization
6. Dealing with uncertainty
7. Multi-objective Analysis
8. Modelling for River Basin Planning.

Course Code: CHMT7066A**Course Description: Introduction to Oil and Gas Offshore Platforms/Pipelines****NQF Credits: 20****NQF Level: 9**

This course introduces the candidate to key concepts around oil and gas offshore platforms and pipelines. Topics include: energy types such as general, fossil fuels; nuclear fuels and renewables; the petroleum industry which includes a general overview, production facilities, terminology and units, petroleum production and consumption; introduction to refining processes and the business of oil; petroleum industry players such as petroleum companies, offshore players and companies; and platform structures covering general information on platforms, mobile and fixed platforms, deep sea platforms, the estimation of structure weight, safety and accidents, and decommissioning.

Course Code: CHMT7067A**Course Description: Tribology: Friction, Wear and Lubrication****NQF Credits: 20****NQF Level: 9**

This course equips candidates with a fundamental understanding of friction and wear, in lubricating mechanical component systems and explores practical maintenance solutions to be implemented for the optimisation of equipment lifetimes and system operations. Topics include: lubrication principles; types of lubricants; oil filtration; gears; brakes; rolling bearings; plain bearings; hydraulic systems; internal combustion engines; compressor operation, condition monitoring and failure analysis.

Course Code: CHMT7068A**Course Description: Underground Coal Gasification****NQF Credits: 20****NQF Level: 9**

This course focuses on the history of Underground coal gasification (UCG) development, the sustainability of southern African coals for UCG (emission reduction, resource extension, social and economic impacts), basic geology (sedimentology, coal seam geology, tectonics, location), hydrogeology, rock mechanics and drilling, environmental, legal and financial considerations, and applications for UCG gas.

Course Code: CHMT7069A**Course Description: CO2 Capture in Power Plants****NQF Credits: 20****NQF Level: 9**

This course aims to develop and apply suitable carbon capture technology to ensure a sustainable future by the reduction of carbon dioxide emissions. It covers three main topics: a brief review of thermal power plants (coal, natural gas), CO₂ formation from thermal power plants, integration of CO₂ capture in power plants, and problems associated with CO₂ capture; methods of gas separation (adsorption, absorption, membranes, distillation, anti-sublimation), as well as a consideration of energy penalties / efficiency reduction caused by CO₂ capture; and compression and conditioning of CO₂ for transport and storage condition, and CO₂ storage

Course Code: CHMT7070A**Course Description: Nanotechnology in Petroleum Reservoir****NQF Credits: 20****NQF Level: 9**

This course focuses on an introduction to nanotechnology of oil and gas; petroleum chemistry; petrophysics; an introduction to chemical reaction engineering; catalysts and catalysis; chemical vapor deposition; interfacial mass transfer; an introduction to petroleum reservoir rock properties; nanotechnology and phase behavior of petroleum reservoir fluids; porosity and capillary pressure and nanotechnology of cavitation & pump selection.

Course Code: CHMT7071A**Course Description: Critical State Soil Mechanics****NQF Credits: 20****NQF Level: 9**

This course provides an understanding of how simple constitutive modelling can be developed within a Critical State Soil Mechanics (CSSM) framework. For clarity of presentation, the ideas are developed within the context of states of stress attainable with triaxial testing. The selection of stress and strain invariants adequate for the triaxial test is considered. The four main components of an elasto-plastic constitutive model are then introduced: Elasticity (limited to the isotropic case), yield surfaces, plastic potentials, and hardening rules. The interactions between these four components are illustrated using the Cam-clay constitutive model and more recent CSSM-based models. Correlations between index properties and CSL parameters that allow preliminary estimations of CSLs are also presented.

Course Code: CHMT7072A**Course Description: Advanced Biochemical Engineering****NQF Credits: 20****NQF Level: 9**

This course introduces the candidate to advanced topics in biochemical engineering. Topics include: advanced microbiology, DNA manipulation and protein synthesis; biological thermodynamics; biological process synthesis and modelling; bio-process analysis and control; advanced separation processes; industrial bio-process case studies; and the development and commercialisation of bioprocesses.

Course Code: CHMT7073A**Course Description: Design and Construction of Welded Structures under Static Loading****NQF Credits: 20****NQF Level: 9**

This course focuses on basic theory of structural systems, fundamentals of the strength of materials, basics of weld design, design principles of welded structures, joint design for welding and brazing, basics of weld design, behaviour of welded structures under different types of loading and design of welded structure with predominantly static loading.

Course Code: CHMT7074A

Course Description: Design and Construction of Welded Structures under Dynamic Loading

NQF Credits: 20

NQF Level: 9

This course focuses on behaviour of welded structures under cyclic (dynamic) loading. The candidate is given the tools to do the following: determination of load, design of cyclic loaded welded structures, design of welded pressure equipment, design of structures of aluminium alloys and an introduction to fracture mechanics.

Course Code: CHMT7075A

Course Description: Research/Industrial Project

NQF Credits: 45

NQF Level: 9

In this course candidates are required to investigate a problem or topic in the general field of engineering which must include: a detailed literature review; data collection, analysis and interpretation; conclusions and commensurate recommendations on the solution to the problem or topic. A comprehensive report demonstrating the candidates' competencies in the investigation, its evaluation and technical reporting must be submitted.

Course Code: CHMT7076A

Course Description: Synthetic Fuels & Processes

NQF Credits: 20

NQF Level: 9

This course focuses on the basic concept of conversion of environmentally dirty carbonaceous materials into clean synthetic fuels via hydrogenation and or carbon removal. Graphical techniques that attempt to decipher the various existing processes and unit operations for clean fuel production, idealised synthetic fuel routes, thermally neutral operations, direct and indirect liquefaction, commercial fuels routes, gasifier reactor modelling and thermodynamic limitations, pyrolysis, Fischer-Tropsch, natural gas and syngas production are discussed.

Course Code: CHMT7077A

Course Description: Research Methodology MSc Eng

NQF Credits: 10

NQF Level: 9

This course is approached from the point of view of what constitutes knowledge in different domains and what is a good research question. It considers when new knowledge makes a contribution to existing knowledge. The research tools of creative problem solving, argument and planning are discussed in detail. The course leads to the development of a research proposal.

Course Code: CHMT7078A

Course Description: Research Methodology MEng (Prof)

NQF Credits: 15

NQF Level: 9

This course is approached from the point of view of what constitutes knowledge in different domains and what is a good research question. It considers when new knowledge makes a contribution to existing knowledge. The research tools of creative problem solving, argument and planning are discussed in detail. The course leads to the development of a research proposal.

Course Code: CHMT7079A

Course Description: Applied Chemical Engineering Thermodynamics

NQF Credits: 20

NQF Level: 9

This course is an introduction to advanced concepts towards the MSc qualification in chemical engineering, and covers the concepts required in applied thermodynamics and applications to process plants. The course trains students to apply their knowledge to relevant engineering problems and problem solving. Other topics include energy analysis and efficiencies, exergy analysis and second-law analysis.

SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

Course Code: CIVN1005A

Course Description: Introduction to Civil Engineering Infrastructure

NQF Credits: 12

NQF Level: 5

This course provides students with an overview of civil engineering infrastructure and how it relates to the socio-economic conditions in South Africa and includes the following topics: an overview of civil engineering, development and infrastructure; the relationship between infrastructure provision and country income level and investment; the description and application of civil engineering infrastructure (e.g. water resources, water quality and supply, transportation and stormwater) and associated issues (e.g. land use and problem soils); and an overview of existing South African guideline books for infrastructure provision.

Course Code: CIVN1997A

Course Description: Practical Training (Civil)

NQF Credits: 0

NQF Level: N/A

This course provides students with relevant practical training in the civil and environmental industry at the end of first year for a minimum period of two weeks. The course uses a combination of delivery modes which include lectures, laboratory investigations and site visits and includes the following topics: plant and associated maintenance; concreting; roads and earth works; shuttering and reinforcement; structural steel fabrication; building trades; and construction procedures; and an introduction to the principles and procedures of health, safety and environment (she) in civil engineering; legislation, policies, safe work practices, hazard identification, risk assessments, emergency plans, accident/incident investigation and mitigation.

Course Code: CIVN1996A

Course Description: Vacation Work (Civil)

NQF Credits: 0

NQF Level: N/A

The student is required to submit a vacation work report detailing the work undertaken during the period.

Course Code: CIVN2008A

Course Description: Materials and Structures I

NQF Credits: 15

NQF Level: 6

(15) (3-1-0.5) (1 term)

This course covers the actual behaviour of some of the materials used in civil engineering, and the way in which simplifying assumptions are made to enable mathematics to represent that behaviour to a sufficient degree of accuracy for practical design purposes is described. Similarly it introduces the behaviour of real structures can be assumed to be simplified is introduced. Topics include:

- 1) strength of materials: definition of normal and shear stresses and strains, analysis of elastic stress and strain, thermal strains; solution of indeterminate problems by compatibility; stress-strain behaviour of materials; theory of elastic bending, torsion of circular sections; applications of plane stress; analysis of combined loading using the principle of superposition
- 2) structural engineering: analysis of pin-jointed frames; relation between load, shear force and bending moment; buckling of simple columns; and design:
- 2) the design process, loading and forces on structures and members and safety factors.

Course Code: CIVN2009A**Course Description: Materials and Structures II****NQF Credits: 15****NQF Level: 6****(15) (3-1-1) (1 term)**

This course has two components and topics include:

- 1) construction materials: theory of elastic bending of composite sections; theory of bending into the plastic region of idealised elastic-plastic materials and introduction to the theory of reinforced concrete; and
- 2) structural engineering: deflection of statically determinate structures by integration; moment area and energy methods.

Course Code: CIVN2010A**Course Description: Numerical Methods****NQF Credits: 15****NQF Level: 6****(15) (3-1-2) (1 term)**

This course focuses on introductory concepts:

- 1) errors, limitations of finite precision machines and error quantification;
- 2) solutions of equations: bisection; linear iteration; Newton-Raphson and Aiken's acceleration algorithm;
- 3) functional interpolation: interpolation with various functions; their merits and demerits; polynomial interpolation; Lagrange interpolation; Chebyshev polynomials and least square interpolation;
- 4) numerical integration: trapezoidal; Simpson, Newton-Cotes and Gaussian;
- 5) solutions of eigenvalue problems: evolution of such problems in engineering and methods of solution;
- 6) solution of ordinary and partial differential equations (ODEs & PDEs):
- 7) evolution of ODEs & PDEs in engineering applications, Initial-value and boundary-value problems, Euler and Runge-Kutta methods, finite difference and finite element methods in 1-D spatial domains; and
- 8) computer coding of some algorithms in a language required of students.

Course Code: CIVN2011A**Course Description: Probability Theory and Mathematical Statistics for Engineers****NQF Credits: 15****NQF Level: 6****(15) (3-1-0) (1 term)**

This course focuses on descriptive statistics (graphical representation of data, measures of location, measures of variability); probability theory (random experiments and random events); probability of random events; conditional probability; independence; random variables; random vectors; mathematical statistics (point estimation, interval estimation), parametric tests, nonparametric tests, correlation analysis and linear regression.

Course Code: CIVN2013A**Course Description: Introduction to Environmental Engineering****NQF Credits: 15****NQF Level: 6****(15) (3-1-0.7) (1 term)**

This course introduces the most critical elements of environmental engineering and science and provides a fundamental basis from which to understand and evaluate the environment and design engineered systems for environmental quality management. These systems include water and wastewater treatment, air pollution control, soil and aquifer pollution remediation, and solid waste management. Critical appraisal of present-day issues concerning our environment, the monetary cost of environmental degradation, and the relevant environmental legislation in South Africa are incorporated into the course.

Course Code: CIVN2014A/CIVN2015A (PT)

Course Description: Engineering Computing

NQF Credits: 15

NQF Level: 6

(15) (3-1-2.5) (1 term)

This course provides students with a basic understanding of programming concepts and fundamentals. It develops skills necessary to design new programming software to perform tasks. It teaches students to use computers effectively and to use some task-specific programs.

Course Code: CIVN2016A/CIVN2017A (PT)

Course Description: Engineering Economics and Infrastructure Planning

NQF Credits: 15

NQF Level: 6

(15) (3-1-0) (1 term)

This course covers: Development and infrastructure; the role of the construction industry in the economy; municipal integrated development plans; guidelines for municipal infrastructure; appraisal of infrastructure projects; economic evaluation of infrastructure projects using techniques such as net present value, cost-benefit, and internal rate of return; demographics; land-use; participatory approaches.

Course Code: CIVN2018A

Course Description: Civil Engineering Theory I

NQF Credits: 7

NQF Level: 6

This course applies the principles of static equilibrium and structural analysis to determine forces and deflections in simple structural systems. Topics include: Loading and structural load paths, the diagramming of shear, moment, and axial forces, and the analysis of trusses.

Course Code: CIVN3001A

Course Description: Construction Materials I

NQF Credits: 15

NQF Level: 7

(15) (3-1-1) (1 term)

This course focuses on three components:

- 1) two dimensional stress and strain analysis, elastic stress-strain functions, Mohr circle in two dimensions;
- 2) shear stresses in beams, shear centres, torsion, and
- 3) reinforced and prestressed concrete, basic concrete technology and laboratory projects.

Course Code: CIVN3004A

Course Description: Geotechnical Engineering I

NQF Credits: 15

NQF Level: 7

(15) (3-1-0.5) (1 term)

This course focuses on scope of geotechnical engineering, simple soil properties, classification of soils, total and effective stresses, shear strength, one-dimensional seepage; lateral pressures, bearing capacity, 2-D seepage and flownets, compaction and laboratory work.

Course Code: CIVN3010A

Course Description: Structural Steel Design

NQF Credits: 15

NQF Level: 7

(15) (3-1-0) (1 term)

This course focuses on methods of design, the design process, load cases and load combinations, requirements of structures, global stability (how to stabilize a structure).

Included are component design of steel: tension members, compression members, beam members, bolting and welding, simple connections, moment connections.

Course Code: CIVN3011A

Course Description: Reinforced Concrete Design

NQF Credits: 15

NQF Level: 7

(15) (3-1-1) (1 term)

This course focuses on loads, beam design (rectangular and "T" beams), slab design (one-way, two-way, flat & prestressed), column design, foundation design, stability, development length and curtailment, layout and reinforcing drawings, structural analysis packages and CAD packages.

Course Code: CIVN3012A

Course Description: Hydrology

NQF Credits: 15

NQF Level: 7

(15) (3-1-0.5) (1 term)

This course deals with the analysis of the spatial and temporal distribution of water in the land phase of the hydrological cycle. It covers the following topics:

- 1) Introduction: Hydrological cycle, Hydrologic systems concepts, hydrologic modelling concepts.
- 2) Rainfall: types of rainfall, rainfall measurement, rainfall characteristics, depth-duration-frequency relationships, spatial variability, averaging techniques.
- 3) Streamflow measurement.
- 4) Evaporation and evapotranspiration: estimation and measurement of evaporation and evapotranspiration rates.
- 5) Infiltration: Phi index method, Horton's method.
- 6) Groundwater: occurrence, movement, basic well hydraulics.
- 7) Storage - Yield analysis.
- 8) Flood frequency analysis: review of statistical concepts, frequency factor analysis, graphical analysis, confidence limits.
- 9) The Rational method.
- 10) Unit Hydrograph theory, unit hydrograph application, synthetic unit hydrographs.
- 11) Flood routing, time-area catchment routing, reservoir routing, Muskingum river routing.

Course Code: CIVN3017A

Course Description: Systems Analysis and Optimisation

NQF Credits: 15

NQF Level: 7

(15) (3-1-0) (1 term)

This course covers:

- 1) basic systems analysis: the need for systems analysis; systems and processes; components of a system; system modelling and analysis;
- 2) introduction to optimisation: the need for optimisation; formulating an optimisation problem;
- 3) Linear Programming (LP): graphical solution the simplex method; applying LP using software
- 4) Dynamic Programming (DP): characteristics of dynamic programming; fundamental approach to solving dynamic programming problems;
- 5) Network models: shortest path problems; maximum flow problems; Critical Path Method

- 6) Genetic Algorithms (GA): how the GA optimises; steps of the GA manual illustration of the GA; applying using software;
- 7) Decision making under uncertainty: the need for decision making under uncertainty; decision making without experimentation; decision making with experimentation; decision trees ;
- 8) Markov Chains: description and characteristics of a Markov Chain; modelling processes as Markov Chains;
- 9) Markov decision processes: Optimising processes modelled as Markov Chains by exhaustive enumeration, solution by linear programming or policy improvement method.

Course Code: CIVN3024A

Course Description: Fluid Mechanics and Hydraulics

NQF Credits: 15

NQF Level: 7

(15) (3-1-1.5) (1 term)

The course introduces the fundamental principles of fluid mechanics and hydraulics and provides the foundation for subsequent work in hydraulic and water engineering. This course includes the following topics: Introduction to water engineering, Fluid properties, Hydrostatics, Buoyancy and stability of floating bodies, Basic hydrodynamics, Flow measurement, Pipe flow and simple pipeline systems, Dimensional analysis and experimentation, Similarity and hydraulic modelling.

Course Code: CIVN3025A

Course Description: Structural Analysis I

NQF Credits: 15

NQF Level: 7

(15) (3-1-1.5) (1 term)

This course includes the following topics:

- 1) introduction: overview of the topics covered and how they fit together;
- 2) equilibrium: summary and recap of equilibrium and how it is used;
- 3) Influence Lines (IL): an explanation IL; the method of determining IL and several examples covered;
- 4) principle of virtual work: this principle is introduced; the equation is derived and several examples covered;
- 5) Muller-Breslau principle and model analysis: this principle is stated; the equation behind the principle derived and several examples of various structures (beams, frames, arches, trusses) covered and the application to model analysis is explained;
- 6) computer methods: local and global axes systems are introduced; the method of rotating one axes system to the other derived; the matrix method of analysis derived; and
- 7) the following structural types are considered in detail: trusses, two-dimensional frames and two dimensional grillages; both the theoretical workings and a detail example presented for each structure type.

Course Code: CIVN3026A

Course Description: Structural Analysis II

NQF Credits: 15

NQF Level: 7

(15) (3-1-1) (1 term)

This course includes the following topics: introduction: an overview of the topics covered and how they fit together; principle of virtual work: this principle is summarised (from Structures IA) and several examples are covered, concentrating on both determinate and indeterminate structures; static and kinematic indeterminacy: these concepts are introduced and examples are covered; flexibility methods: flexibility principles are considered using the principle of virtual work; the flexibility method of analysis is introduced and examples of determinate and indeterminate structures are covered; stiffness methods: stiffness principles are considered; the stiffness method of analysis introduced; examples of determinate

and indeterminate structures are covered; how the stiffness method ties in with computer methods of Structures IA explained; and special problems that include temperature effects and settlement of foundations are presented; stability of structures: the concept of buckling is presented; linear elements (beams and struts) are considered; several methods, both analytical and numerical are introduced and examples worked through.

Course Code: CIVN3027A

Course Description: Transportation Engineering

NQF Credits: 15

NQF Level: 7

(15) (3-1-0) (1 term)

This course has the following topics:

- 1) Introduction to transportation engineering;
- 2) Traffic analyses;
- 3) Traffic control, safety and management;
- 4) Geometric design;
- 5) Introduction to pavements and;
- 6) Pavement design.

Course Code: CIVN3029A

Course Description: Civil Engineering Theory II

NQF Credits: 7

NQF Level: 7

This course focuses on common building materials and their application in structural systems. It investigates material properties and behaviour, limit states design, and construction methods.

Course Code: CIVN3030A

Course Description: Civil Engineering Theory III

NQF Credits: 7

NQF Level: 7

This course explores more complex, but common structural systems in buildings. It considers material properties, types of structural foundations and connections, and the structural design of beams, columns and slabs. It further provides an understanding of geotechnical information and its relevance for structural design is presented.

Course Code: CIVN3032A

Course Description: Practical Training (Civil)

NQF Credits: 0

NQF Level: N/A

This course provides students with relevant practical training in the civil and environmental engineering industry. The course covers the following topics; infrastructure maintenance, concreting, roads and earth works, shuttering and reinforcement, structural steel fabrication, construction procedures, an introduction to the principles, procedures and legislation of occupational health and safety (OHS), and computer modelling packages used in the civil and environmental engineering industry.

Course Code: CIVN4000A

Course Description: Construction Materials II

NQF Credits: 21

NQF Level: 8

(21) (3-1-0.3) (1.5 terms)

This course includes the following topics:

Properties of structural and building materials; thermal and acoustic properties; deterioration; effects of fire; intermediate concrete technology; bitumen and asphalt technology; plastics; rubber; paints and adhesives; corrosion of metals; fatigue, creep and relaxation; calculation of stresses from measured strains; yield criteria for ductile brittle materials; effect of stress concentrations; three-dimensional stress and strains; Mohr circle in three dimensions; characteristics of elasto-plastic and visco-elastic materials, structural timber and project work.

Course Code: CIVN4004A

Course Description: Geotechnical Engineering II

NQF Credits: 21

NQF Level: 8

(21) (3-1-0.5) (1.5 terms)

This course includes the following topics:

Stress distributions; soil consolidation and settlement; heave and collapse of soils; soil improvement; soil profiles and site investigation; in situ testing; Slope stability. Filters and geosynthetics Probability piled foundations; numerical analysis of geomaterials and laboratory work.

Course Code: CIVN4005A

Course Description: Investigational Project

NQF Credits: 27

NQF Level: 8

(27) (0-1-0) (1.5 terms)

In this course, students are required to carry out an investigational project. The assessment of the project includes technical content of the report and professional communication through the media of a poster and oral presentation.

Course Code: CIVN4006A

Course Description: Integrated Resource Management

NQF Credits: 21

NQF Level: 8

(21) (3-0-0) (1.5 terms)

This course has three components:

- 1) Integrated project management: achievement of economic and environmental sustainability through best practice including quality management, value engineering, supply-chain management, and relational contracts;
- 2) Environmental management: introduction to environmental management; government framework for environmental governance and management in South Africa; environmental assessments; and
- 3) Sustainable development and integrated water resource management: the three pillars of sustainability; integration and resources examined; water resources; water resource management; multi-disciplinary approaches; legal, social and economic factors; supply and demand.

Course Code: CIVN4010A

Course Description: Hydraulic Engineering

NQF Credits: 21

NQF Level: 8

(21) (3-1-1) (1.5 terms)

This course includes the following topics:

- 1) open channel flow: introduction; uniform flow; rapidly varied flow; specific energy; critical flow; controls; momentum equation; hydraulic jump; gradually varied flow; profile classification and synthesis; gradually varied flow computation – numerical step methods;
- 2) hydraulic structures: weirs; flumes; underflow gates; spillways; stilling basins and energy dissipators; and culverts;

- 3) pipeline systems: brief overview of head loss equations and simple pipeline systems; design of distribution systems (branch and loop systems); pipe materials and appurtenances; design of pump-pipeline-reservoir systems; hydraulic transients in pipelines and surge protection.

Course Code: CIVN4016A

Course Description: Civil Engineering Theory in Construction

NQF Credits: 18

NQF Level: 8

This course introduces students to geotechnical engineering and construction materials. Topics include:

- 1) Geotechnical engineering: Effective stresses, shear strength, compaction, seepage, lateral pressures, bearing capacity, and introduction to foundations; and
- 2) Construction materials: fundamentals of material behaviour: performance criteria, elastic stress-strain functions, creep, shrinkage and relaxation and fatigue, intermediate concrete technology: hydration chemistry, binder types and concrete durability

Course Code: CIVN4014A

Course Description: Structural Engineering

NQF Credits: 21

NQF Level: 8

(21) (3-1-1) (1.5 terms)

This course includes the following topics: analysis of plates and simple shells; dynamic analysis; yield line analysis; plastic analysis of beams and frames; moment distribution and laboratory and project work.

Course Code: CIVN4015A

Course Description: Civil Engineering Design

NQF Credits: 27

NQF Level: 8

(27) (2-0-0) (1 block)

This course includes the following topics: planning and design of civil and environmental engineering works; associated reports; specifications and bills of quantities and aspects of professional practice.

Course Code: CIVN7000A

Course Description: Non-linear Analysis of Structures

NQF Credits: 20

NQF Level: 9

This course focuses on fundamentals of non-linear analysis; geometric non-linearity frame stability and P-D methods; modelling material non-linearity in structural members and associated constitutive relationships; cable structures and other examples and computer methods of analysis.

Course Code: CIVN7005A

Course Description: Dynamic Loading and Analysis of Structures

NQF Credits: 20

NQF Level: 9

This course focuses on classical and computer methods of analysis of the vibration of single and multi-degree of freedom structures, plates and shells including the calculation of natural frequencies and mode shapes and the structural response to various applied loads; loads considered will include harmonic and impulse loads, spectral analysis of general random loads and wind loads and human and machine tolerance to vibration.

Course Code: CIVN7006A

Course Description: Employment Creation in Road Construction and Maintenance

NQF Credits: 20

NQF Level: 9

This course focuses on theoretical basis for labour-intensive methods, case studies in Africa, organisational structures, technical standards, productivity, labour/equipment rates, equipment and methods of haulage, training, maintenance, socio-economic factors and implications in South African context.

Course Code: CIVN7007A**Course Description: Employment Creation in the Construction and Maintenance of Infrastructure****NQF Credits: 20****NQF Level: 9**

Please note that this is a different course from "Employment Creation in Road Construction and Maintenance". This course focuses on theoretical basis for employment-creation in the construction and maintenance of infrastructure; detailed consideration of the productivity of labour and equipment, design, technical standards, wage rates, haulage, training, maintenance and socio-economic factors; case studies of material programmes of employment creation in road construction and maintenance that are in progress elsewhere in Africa; implications for South Africa; case studies of various infrastructure projects in South Africa and dam construction, irrigation projects, road construction, municipal infrastructure (roads, water supply, sanitation, storm water drainage).

Course Code: CIVN7012A**Course Description: Advanced Design of Structural Steel****NQF Credits: 20****NQF Level: 9**

This course focuses on limit-state design approach; recent developments in design codes for structural steelwork, including new South African code; stability of columns, beams and beam columns; instability of frames and plates; composite construction; plastic design and laboratory and design projects.

Course Code: CIVN7013A**Course Description: Waste Water Engineering****NQF Credits: 20****NQF Level: 9**

This course focuses on wastewater quality review; sources of wastewater; impacts on the environment from wastewater discharge and other environmental considerations; principles of wastewater treatment and reactor design and kinetics; physical, chemical and biological treatment processes; unit operations for wastewater treatment - preliminary treatment, secondary treatment, tertiary treatment; sludge quantities, treatment and disposal; experimental and pilot plant studies of unit operations and wastewater treatment plants and plant design.

Course Code: CIVN7016A**Course Description: Hydraulic Structures****NQF Credits: 20****NQF Level: 9**

This course focuses on the review of relevant open channel flow concepts, rapidly varied flow; transitions - expansions and contractions for subcritical and supercritical flow, prediction of standing waves; spillways - control concept, overflow, side channel, shaft and siphon spillways, chutes, cavitation, and aeration; culverts; energy dissipation - hydraulic jumps on horizontal and sloping surfaces, stilling basin design, other energy dissipation structures; flow measurement structures - weirs, flumes, measurement errors; intake structures - river intakes, sediment control, pump sumps, vortices and air entrainment and Scour - local scour and protection, river bed and bank protection.

Course Code: CIVN7018A**Course Description: Project Management in Construction****NQF Credits: 20****NQF Level: 9**

This course focuses on project organisation and life cycle; project definition, evaluation and feasibility study; communication, leadership, persuasion and cooperation in project management; contract strategy and management of change, risk and uncertainty; project management issues and the state of the art.

Course Code: CIVN7020A**Course Description: Project Management in Developing Areas****NQF Credits: 20****NQF Level: 9**

This course focuses on basic theories of development economics, cultural and socio-political factors, issues and problems in the management of development projects and basic principles of project management as applied to the management of construction projects in developing areas.

Course Code: CIVN7021A

Course Description: Advanced Geotechnical Site Investigation

NQF Credits: 20

NQF Level: 9

This course focuses on principles and techniques of site investigation, soil profiling, identification and classification of soils, principles of operation of vane shear, cone penetrometer, plate loading and pressure meter tests, load tests on piles, dynamic measurements on piles, field work) which depends on cooperation with local geotechnical testing organisations), –providing field practice in soil profiling and at least two of field test methods, geophysical methods and pressure meter tests.

Course Code: CIVN7022A

Course Description: Advanced Geotechnical Testing

NQF Credits: 20

NQF Level: 9

This course focuses on literature survey; laboratory work (preparation of samples, full range of triaxial tests, consolidation tests, double oedometer tests, swelling pressure and lateral pressure tests, cyclic loading of sand and slimes), x-ray diffraction and testing of rock samples.

Course Code: CIVN7023A

Course Description: Deep Foundations and Anchors

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics: the influence of geology and soil profile on the selection and performance of piled foundations; application of wave equation theory to the prediction of pile behaviour; integrity testing of piles; slurry techniques in below ground construction; prediction of pile settlements; prediction of anchor load capacity and load-deflection characteristics and anchor construction and testing procedures.

Course Code: CIVN7024A

Course Description: Environmental Management

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics: issues of environmental management; principles of environmental management; major types of waste and their sources; the nature of waste discharges and their effects on the receiving environment; Waste load allocation; environmental management, policy and law; Standards, permits, charges, subsidies, equity, and other important issues; institutional and organisational aspects of environmental management; movement and fate of pollutants and other substances in the environment; environmental systems analysis, environmental impact assessment, macro and micro scale environmental effects, integrated environmental management; new technologies for environmental management and decision making and technical, legal, economic, social and political aspects of environmental management.

Course Code: CIVN7025A

Course Description: Construction Site Management

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics: planning - the role of project planning and the use of bar charting techniques; network analysis; planning for repetitive construction; the use of computers in planning; estimating and tendering - the estimating process; site inspections and site overheads; the calculations and decisions in tendering; cash flow and cost control and plant management.

Course Code: CIVN7026A**Course Description: Analysis and Design of Shell Structures****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: analysis and design of shells of revolution and translation with particular emphasis on thin concrete shells; membrane and bending theory; symmetrical and non-symmetrical loading; aspects of stability and safety and laboratory work.

Course Code: CIVN7027A**Course Description: Theoretical Soil Mechanics****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: soil as a continuum; invariants of stress and strain; elasticity and soil behaviour; non-linear elastic models; essential features of plasticity theory; soil as a plastic material; yield and failure criteria; concept of critical states for soil and recent developments in constitutive modelling.

Course Code: CIVN7028A**Course Description: Earth Pressures and Retaining Structures****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: conditions of overall stability; Rankine and Coulomb methods of analysis; friction circle method; structures with restricted deformations; strutted excavations; pressures due to surcharges; use of berms for increasing stability; anchor design; soil nailing and buried pipelines and culverts.

Course Code: CIVN7029A**Course Description: Urban Engineering Context****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: introduction to urban engineering; urbanisation theory; demographic studies - national and regional development in South Africa; development of the metropolitan and other urban areas in South Africa; Urban planning and engineering - history; urban planning - general principles, statutory procedures and development control and incentive; urban planning - residential amenity, business and industrial areas; transport planning; land use, transport and alternative approaches to the planning and economic development of the megalopolis; implications of political choice and redistribution economics; public participation and the environment of the urban areas. futurology.

Course Code: CIVN7030A**Course Description: Science and Technology Policy for Development****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: the scope of science and technology policy - institutions, mechanisms, sources and choice of technology and issues in technology transfer; indicators of development and alternative models; development needs of South Africa and the southern African region; Industrialisation- import substitution vs export orientation; environmental considerations; beneficiation of minerals; energy policy; infrastructure development - road and rail transport, water supply and sanitation and housing; the role of telecommunications in development; current policy frameworks in South Africa and implementation of policy options.

Course Code: CIVN7033A**Course Description: Water Quality Modelling****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: water chemistry, pollution processes, water in the environment, artificial and natural end processes; stream models, nonconservators; lakes and seas; numerical methods and computer simulation.

Course Code: CIVN7035A**Course Description: River Hydraulics****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: fluvial system characteristics and problems; open channel fluid mechanics; channel conveyance and flow resistance, friction, bed forms and alluvial roughness, composite roughness and compound sections; initiation of sediment movement, scour and scour protection; sediment transport theory and models; nonuniform flow analysis; water and sediment routing; river morphology, regime theory, stability; river response to development, river control and environmental aspects.

Course Code: CIVN7036A**Course Description: Finite Element Analysis of Structures****NQF Credits: 20****NQF Level: 9**

This course examines the theory and practical application of finite elements. Beam elements, plane stress and plane strain elements, plate bending elements, and brick elements are theoretically derived. The practical application of finite elements, non-linear theory, modelling of reinforced concrete structures and the modelling of composite structures are discussed. Several assignments are set to give students opportunity to analyse common structural problems.

Course Code: CIVN7038A**Course Description: Project Management – Part I****NQF Credits: 20****NQF Level: 9**

This course focuses on project definition and life cycle, the project management organisation, the role and responsibility of the project manager and coordination management functions in an environment of conflict and uncertainty, the legal environment, planning and control of time, cost and performance and issues in project management.

Course Code: CIVN7039A**Course Description: Project Management – Part II****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: the planning and control cycle; essential features of real control (influence of resource availability); interaction of time and cost; the organisation required for planning and control of construction projects; the use of work study for on-site construction planning; cash flow planning on a construction project; review of planning methods in practice, including the critical path method, the line of balance and the earned value technique computer applications in planning and control.

Course Code: CIVN7042A**Course Description: Selected Topic****NQF Credits: 20****NQF Level: 9**

In this course candidates are required to submit a selected topic that is a research-based assignment as approved by the postgraduate coordinator.

Course Code: CIVN7044A**Course Description: Pollution Prevention and Abatement****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: indicators of pollution management; the environmental assessment process; industrial pollution management principles; industrial pollution management (key policy lessons); pollution charges (lessons from implementation); economic analysis of environmental externalities; least cost approaches to reducing emissions; environmental standards; comparative risk assessment; monitoring environmental quality; the economic tool of pollution; integrated environmental management, analytical support for cost effective pollution control; ISO 14000 environmental management system; industrial pollution and abatement practice for different sectors of industry.

Course Code: CIVN7045A

Course Description: GIS Applications in Environmental Planning, Management and Decision-Making

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics: natural resources planning and management concepts; new information technologies and environmental planning; environmental management functions and processes; inventories and cadastres; prerequisites for effective implementation of new information technologies; GIS modelling - spatial concept and models of spatial information, the modelling process and spatial data models, spatial database concepts, geographic data types, database models and systems, data quality problems; functional requirements of GIS systems for planning, management and decision making; strategies for initiating GIS and cost of initiating GIS.

Course Code: CIVN7046A

Course Description: Advanced Prestressed Concrete Design

NQF Credits: 20

NQF Level: 9

This course provide both a basic and in-depth understanding of the behaviour of prestressed concrete structures at both service and ultimate load conditions and includes discussion on the application of prestressed concrete elements with particular reference to bridge design. Topics include: methods and basic of prestressing design for flexure and shear at both elastic and ultimate limit states; losses in prestress; end block design; continuous beams; concordant profiles; partially prestressed beams; prestressed concrete flat slabs and composite (prestress + in-situ) beams.

Course Code: CIVN7047A

Course Description: Advanced Reinforced Concrete Design

NQF Credits: 20

NQF Level: 9

This course provides an understanding of the methods of analysis and design of reinforced concrete structures. Aspects of the code SABS 0100 area discussed with design examples and comparison made with other international codes. Topics include: material properties; behaviour and strength of reinforced concrete under combined loading; deflection and crack control; ductility of reinforced concrete in flexure; deep beams and shear walls; flat slabs; yield line analysis; short and slender columns and application - RC frame/shear wall construction.

Course Code: CIVN7051A

Course Description: Introduction to Industrial Ecology

NQF Credits: 20

NQF Level: 9

This course introduces candidates to industrial ecology as a model for achieving industrial sustainability through systematic planning of industrial activity and focuses on the principles, tools and techniques it uses. Industrial Ecology (IE) is. Topics discussed include: immediate benefits from improved economic performance which has influence on and supports long term sustainability: planned symbiotic interactions within the industrial systems and other organisations; a framework for proactive management of human impacts on the natural environment, emerging at a time when traditional de-pollution approaches (end of pipe) are increasingly regarded as inefficient and implementation of ecologically sustainable developments; borrowing ecological principles and applying them to the design and management of commercial systems and the infrastructure required by them.

Course Code: CIVN7053A**Course Description: Design for the Environment****NQF Credits: 20****NQF Level: 9**

In this course the rationale and methodology of design for environment and a pragmatic tool for fulfilling the principle of sustainable development through the development of eco-efficient products and processes that simultaneously increase the profitability of the products and services and benefit the global environment is discussed. An informative introduction and a useful foundation to apply design for environment principles and methods are provided. Many concrete techniques, guidelines and examples to educate product development teams, both veterans and novices, on the practical aspects of design for environment are reviewed. A life-cycle approach, which considers the “cradle to cradle” costs and benefits associated with the materials acquisition, manufacture, use, disposal and recovery of products is emphasised and an overview of the cultural, political and economic changes that are transforming the role of environmental management in the business world.

Course Code: CIVN7054A**Course Description: Air Resources Engineering****NQF Credits: 20****NQF Level: 9**

This course provides a brief overview of the nature and effects of air pollutants on the biosphere, the legal requirements with regard to permitted emission levels; the specialist knowledge and skills required to select and implement air pollution abatement technologies and a philosophy in which air elimination is a design criterion.

Topics include:

- 1) developing an understanding and awareness of air pollution and technologies available to reduce and eliminate pollution;
- 2) enabling candidates to obtain and analyse the data required to identify and monitor air pollution;
- 3) enabling candidates to select and implement suitable technology for air pollution control; and
- 4) developing an understanding of design philosophy and approach, to solving pollution problems before a new design is finalised.

Course Code: CIVN7058A**Course Description: Rural Water Supply and Sanitation****NQF Credits: 20****NQF Level: 9**

This course focuses on characteristics of rural communities; water supply in rural communities; sanitation in rural communities; the consequences of poor water supply and sanitation; improving water supply and sanitation in rural communities; appropriate methods and technologies of water supply and sanitation for rural communities.

Course Code: CIVN7059A**Course Description: Water Management****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: global water situation - sectoral water requirements and available water in space and time; IWRM - its basic principles; implications of integration in water resources management; interdisciplinary and multi-sectoral approach to planning, design and management; social aspects of water - access to water; gender, equity, control of water, affordability; economics of water - resource valuation and pricing, cost recovery and pricing, economic rights to water, optimal water use and efficiency, cost-benefit analysis; water conservation and demand management; community-based water management practices - participatory methodology, community, traditional systems, decentralisation; natural disaster management and ecosystem resilience; droughts; floods and institutional and legislative aspects of water management.

Course Code: CIVN7060A**Course Description: Hydraulic Modelling****NQF Credits: 20****NQF Level: 9**

This course focuses on the concept of hydraulic modelling; different conceptual approaches to modelling of hydraulic systems; river and groundwater steady and unsteady state flow modelling in one spatial dimensions using finite difference; finite element and boundary element method; mathematical description of flow, boundary and initial conditions; extensions of modelling concepts to two and three dimensions and application of available computer hydraulic software to flow problems.

Course Code: CIVN7061A**Course Description: Water Supply and Urban Drainage****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: water users and their consumption patterns, planning, design, operation and management of water supply systems, pump-pipeline-reservoir systems, water demand management and loss control, asset management; storm runoff estimation and requirements for good storm design; design of drains, gutters, and culverts, storm water drainage management and computer models for water supply and urban drainage.

Course Code: CIVN7062A**Course Description: Design of Masonry Structures****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: performance requirements; limit states design; loads and load combinations; properties of masonry materials; construction aspects; design for vertical and lateral loads; design for combined vertical and lateral loads; robustness and stability; evaluation and design of non-standard walling systems; design of arches and detailing; reinforced masonry; seismic design and retrofitting of masonry structures and developments in SA and European codes and standards.

Course Code: CIVN7063A**Course Description: Chemistry, Durability and Performance of Concrete in Structures****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: the role of chemistry in concrete; the chemistry of cement; chemical admixture interactions; extender effects; structure of concrete; nature and characteristics of degradation processes in field concretes due to chloride attack; carbonation, alkali-silica reaction; sulphate attack; temperature effects; deleterious agents under aggressive environments; preventative and remedial measures; performance and service life prediction and life cycle cost analysis for reinforced concrete.

Course Code: CIVN7064A**Course Description: Advanced Concrete Technology****NQF Credits: 20****NQF Level: 9**

This course focuses on cement hydration, microstructural development, pore structure, chemical admixtures and extenders, cracking in concrete; evaluation and repair and fracture mechanics. Topics include: concrete deterioration - basics, diagnosis and rehabilitation strategies; physical damage processes - abrasion, frost action, permeability and diffusion; chemical processes - corrosion of reinforcement, alkali-aggregate reaction, sulphate attack, acid attack and other deleterious agents; fire damaged structures; service life–durability index approach, life cycle cost analysis for reinforced concrete; special concretes - shotcrete, high strength concretes, self-levelling concrete, clay concrete, roller-compacted concrete, polymer and polymer-modified concrete, light-weight concrete and tremie concrete; field applications; an introduction to instrumentation and analytical techniques in concrete - calorimetry; oxygen permeability and sorptivity, water permeability; mercury intrusion porosimetry; pore solution expression and analysis; XRD and DTA/DSC/DGA; optical microscopy; scanning electron microscopy and chemical analysis of hardened concretes.

Course Code: CIVN7065A**Course Description: Water Resources Planning****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: water resources planning and management-an overview: planning and management issues: some case studies, the need to plan and manage, system components, planning scales and sustainability, planning and management, meeting the planning and management challenges.

- 1) Water resource systems modelling: its role in planning and management: modelling of water resources systems, challenges in water resources systems modelling, developments in modelling.
- 2) Modelling methods for evaluating alternatives: plan formulation and selection, modelling methods: simulation or optimization, model development, managing modelling projects, issues of scale.
- 3) Optimization methods: comparing time streams of economic benefits and costs, non-linear optimization models and solution procedures, dynamic programming, linear programming.
- 4) Performance criteria in systems modelling: performance criteria and general alternatives, informed decision-making, quantifying performance criteria, multi-criteria analyses, statistical summaries of performance criteria.
- 5) River basin planning models: modelling the natural resources system and related infrastructure, modelling the socio-economic functions in a river basin, river basin analysis.

Course Code: CIVN7066A**Course Description: Durability, Assessment and Repair of Concrete Structures****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: design for durability; concrete degradation processes; condition assessment - identification of existing damage mechanisms in concrete structures, investigation and monitoring; structural assessment - load testing, cracking and section analysis; time analysis for creep, shrinkage and elasticity; effective modulus method (EMM), age-adjusted EMM; repair options and techniques - patching, crack repairs and overlays; electrochemical techniques – re-alkalization, chloride extraction, cathodic protection; repair materials – grouts, shotcrete, polymers and modified concretes, and other cement-based repair materials; surface coatings, epoxy injection, sealants, emerging repair techniques; structural repairs – strengthening and upgrade; fire damaged structures; service life prediction - durability index approach and other existing prediction models, life cycle costing for reinforced concrete; practical examples and case studies. Students are required to complete an exam and submit a project report that may involve a lab experiment, literature review or field case study.

Course Code: CIVN7068A**Course Description: Environmental Engineering Design****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: principles of environmental design - complex adaptive systems; causes of environmental impacts; drivers of environmental change; current responses to environmental problems; life-cycle assessment - principles, techniques and applications; environmental design at the urban scale - rapid urbanisation; urban heat island effect; conventional versus integrative approaches to the provision of urban infrastructure; building design - legislation and codes of practice; principles of green design; responsible design for climate and comfort; alternative materials and processes and design for minimising construction waste.

Course Code: CIVN7069A**Course Description: Managing the Environmental Impact of a Nuclear Energy Project****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

global environmental issues; environmental issues specific to South Africa or other specified region; creating sustainable models of environmental management; development of disaster mitigation and emergency management principles and their application in various nuclear projects; issues around the management of environmental stakeholders and their concerns including: strategies for radioactive waste management; siting of nuclear projects; and rehabilitation of the environment; and the environmental stewardship of a nuclear project from inception of the project to final release after rehabilitation of a site.

Course Code: CIVN7070A

Course Description: Research/Industrial Project

NQF Credits: 45

NQF Level: 9

In this course candidates are required to investigate a problem or topic in the general field of engineering which must include: a detailed literature review; data collection, analysis and interpretation; conclusions and commensurate recommendations on the solution to the problem or topic. A comprehensive report demonstrating the candidates' competencies in the investigation, its evaluation and technical reporting must be submitted.

Course Code: CIVN7071A

Course Description: Critical State Soil Mechanics

NQF Credits: 20

NQF Level: 9

This course provides an understanding of how simple constitutive modelling can be developed within a Critical State Soil Mechanics (CSSM) framework. For clarity of presentation, the ideas are developed within the context of states of stress attainable with triaxial testing. The selection of stress and strain invariants adequate for the triaxial test is considered. The four main components of an elasto-plastic constitutive model are then introduced: Elasticity (limited to the isotropic case), yield surfaces, plastic potentials, and hardening rules. The interactions between these four components are illustrated using the Cam-clay constitutive model and more recent CSSM-based models. Correlations between index properties and CSL parameters that allow preliminary estimations of CSLs are also presented.

Course Code: CIVN7072A

Course Description: Analytic Methods in Geomechanics

NQF Credits: 20

NQF Level: 9

This course offers a deep knowledge of mathematical theory in rock mechanics and geomechanics. Analytic methods cover major topics such as analysis of stresses, strains stress rotation in three dimensions, index and tensor notation for the analysis of three dimensional stress problems and application of complex variable method of 2D geotechnical problems.

Course Code: CIVN7073A

Course Description: Transport Modelling and Analysis

NQF Credits: 20

NQF Level: 9

This course introduces candidates to the principles of modelling and analysis of transportation systems. The course explores the theories of transport modelling and the various modelling approaches that have been developed over the years, as well as their planning applications. Topics include: introduction to transport planning, modelling and analysis; classification of models for multimodal transportation systems; data collection and analysis; the classical four-step transport model; traffic flow theory and queueing models.

Course Code: CIVN7074A

Course Description: Management of Tailings Storage Facilities

NQF Credits: 20

NQF Level: 9

This course covers the critical aspects of the safe management of tailings storage facilities. Topics include; an overview of the global tailings landscape, applicable guidelines and standards, construction methods of tailings storage facilities, deposition alternatives and dewatering schemes, laboratory and in situ geotechnical testing of tailings, monitoring strategies, geotechnical failure modes, basics of liquefaction, water balances, lessons from catastrophic tailings dam failures, and tailings dam closures.

Course Code: CIVN7075A

Course Description: Sustainability for the Built Environment

NQF Credits: 20

NQF Level: 9

The course focuses on sustainability in the built environment with a particular focus on developing countries. The course provides a problem-based quantitative approach to sustainable design and development. Regulations and guidelines in the ambit of sustainability are discussed and applied to solve real-world engineering problems. Resource management and quantitative methods to evaluate the societal, environmental and economic impact of engineering solutions are key skills developed in this course. The use of engineering methodologies to evaluate the environmental performance of an engineering solution is addressed.

SCHOOL OF COMPUTER SCIENCE AND APPLIED MATHEMATICS

Course Code: APPM1000A

Course Description: Applied Mathematics (Arch)

NQF Credits: 7

NQF Level: 5

Vector algebra, systems of coplanar forces, transversely loaded beams, frameworks, centres of gravity.

Course Code: APPM1022A

Course Description: Introductory Statistics for Construction

NQF Credits: 18

NQF Level: 5

This course covers the following topics:

- 1) Descriptive statistics: Basic concepts; collection of data; organisation of data (rod diagrams; histograms); profiles of frequency distributions; mathematical description of data (mean; mode; median; range, standard deviation; variance, moment coefficient of skewness, quantiles).
- 2) Combinatorics: The symbol $n!$; mutually exclusive events; the fundamental laws of counting; permutations and combinations.
- 3) Probability: Theoretical probability; dependent and independent events; the laws of probability; empirical probability.
- 4) Probability distributions of a Discrete Variable: Introduction to probability distributions; probability distributions of a discrete variable; the binomial distribution; sampling from a large dichotomous population; the Poisson distribution.
- 5) Probability distributions of a Continuous Variable: The probability density distribution; the normal distribution; the standard normal distribution; application of the standard normal distribution to binomial and Poisson distributions
- 6) Sampling distributions: Distribution of sample mean; distribution of differences between two numeric populations; the distribution of sample mean differences; the distribution of sample count/proportion differences.
- 7) Inferential Statistics: Estimation Theory: Overview; estimation theory; confidence intervals for normally distributed statistics; confidence interval for the population proportion.
- 8) Inferential Statistics: Decision Theory: The statistical experiment; errors; the test statistic; hypothesis testing (example from a numeric population, example from a dichotomous population, examples from populations where the parameters are unknown, distributions involving sample proportions).
- 9) The Student's t-Distribution: the student's t-test; difference of means.
- 10) The χ^2 Distribution: the χ^2 Test; Definitions; testing distributions; two-way cross-classifications.

- 11) The F-Distribution: Applications; comparing population variances.
- 12) Correlation Statistics: types of correlation; curve fitting (linear regression, least squares parabola, least squares power equation, least squares exponential equation); the Pearson correlation coefficient; bivariate populations/distributions (t and z tests); regression toward the mean.
- 13) Computing: Statistical analysis of data using spread sheets.

Course Code: APPM1023A

Course Description: Mathematical Techniques for Planners

NQF Credits: 18

NQF Level: 5

This course begins by contextualising the study of mathematical techniques in terms of the requirements of planning. The unit then provides review of area and volume; rate, ratio and proportion, percentage, density, straight line graphs, indices and Logarithms, logarithmic graphs. The unit provides an introduction to graphic literacy, least squares and polynomial interpretation. It also provides an introduction to concepts from surveying as well as introduction to financial mathematics.

Course Code: APPM2013A

Course Description: Biomedical Statistics and Numerical Methods

NQF Credits: 6

NQF Level: 6

(6) (3-1-0) (1 term)

Basic statistical concepts including probability, distributions, hypothesis testing, experimental design. An introduction to numerical methods will also be included.

Course Code: APPM2017A

Course Description: Applied Mathematics IIA

NQF Credits: 13

NQF Level: 6

(13) (3-0.75-0) (1 term)

This course introduces the second year Mining Engineering students to the methods of Applied Mathematics. These methods include modelling and solving linear ordinary differential equations arising in a free, a driven and a damped mechanical oscillating system; solving difference equations; finding centres of gravity of rigid and planar objects. The course further enables students to: solve systems of linear constant coefficient ordinary differential equations using methods such as the decoupling method; model and solve systems of oscillating particles using linear algebra. The derivation and solution using Fourier series method of linear partial differential equations arising in Engineering practice, such as the heat equation and the wave equation also forms part of the course.

Course Code: APPM2019A

Course Description: Quantitative Methods for Planners II

NQF Credits: 12

NQF Level: 6

This course has arisen out of the need to describe aspects of the real world in such a way that its behaviour can be explained and predicted. Mathematical modelling is the key to production of mathematical equations which describe phenomena and systems. Foundation skills required to analyse data sets and build predictive models from given data sets are developed in this course. Emphasis is placed on understanding proportions and significance of components of data, and on developing the necessary computer skills in the analysis and presentation of data. Students are expected to develop skills in communication of the concepts and methods of statistical analysis and model building. This course covers the following topics: basic statistical analysis including graphical representations of data and statistical summaries of data, probability distributions, random variables, confidence intervals, hypothesis testing, significance testing, linear regression and linear correlation.

Course Code: APPM3021A**Course Description: Computational Mathematics****NQF Credits: 15****NQF Level: 7****(15) (4-1-0) (1 term)**

In this course the following is covered:

- 1) Objective: the student will obtain an understanding of the concepts, limitations and advantages of using computers in carrying out mathematical computations.
- 2) Errors. Systems of linear and nonlinear equations. Polynomial interpolation. Curve fitting. Numerical differentiation. Numerical integration. Ordinary and partial differential equations. Concepts of Finite element methods. Symbolic computation. Computer memory usage, overheads and time constraints of numerical algorithms.

Course Code: APPM3037A**Course Description: Numerical Methods (Metallurgy)****NQF Credits: 9****NQF Level: 7**

The Numerical Methods Course serves as an introduction to the most important areas of computational mathematics, with emphasis on algorithms for solving practical problems. This course provides students with mathematical problem solving skills and an appreciation of computational techniques involved in engineering using numerical algorithms. In detail, this course is design to introduce the students to key concepts of direct and iterative methods for solving linear algebraic equations as well as computational techniques for solving nonlinear equations using iterative methods; Furthermore, this course will apply the techniques of polynomial interpolation and least squares approximation in solving computational and engineering problems and will expose the students to key mathematical concepts such as numerical differentiation, Richardson extrapolation; numerical integration; numerical solution of ordinary differential equations (initial boundary value problems)

Course Code: COMS2004A**Course Description: Data Structures and Algorithms****NQF Credits: 18****NQF Level: 6****(18) (4-1-1) (1 term)**

- 1) The first part of the course introduces students to various data structures (ways of representing values and associations between values), how these data structures can be represented in a computer memory and algorithms for manipulating these data structures. Important characteristics (e.g. Efficiency, time and space complexity) of these data structures and algorithms are examined.
- 2) The second part of the course is an introductory study of algorithms and how to design and specify correct and efficient simple algorithms. Topics covered are: problem assessment, ways of expressing algorithms, analysis of simple algorithms, and evaluation of appropriate algorithms.

SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT

Course Code: BUQS1004A**Course Description: Construction Drawings****NQF Credits: 12****NQF Level: 5**

This course focuses on: equipping students with the skills to convert 2-D concepts into physical 3-D models; developing an understanding of what the production of graphical design information, and documentation, entails; enabling familiarity with industry practice in the notation and conventions used in 2D representations; an introduction to 2-Dimension and 3-Dimensional model building as tools to aid in the management of the design process; the understanding of construction drawings, and the assembly of industry standard construction drawings. At the end of the course the student is expected to be able to read and interpret a building drawing.

Course Code: BUQS1005A**Course Description: Construction and The Environment****NQF Credits: 12****NQF Level: 5**

This course introduces the basic materials in construction and their environmental impact. It seeks to demonstrate a relationship between the natural and the built environment, and the current trends in mitigating the carbon footprint of buildings. The scientific analysis of the environment as a system is central to the course, with the introduction of ecology, geology and basic climatology. At the end of the course the student is expected to have a clear discernment of the environmental interaction of buildings.

Course Code: BUQS1006A**Course Description: Construction Technology I****NQF Credits: 12****NQF Level: 5**

This course introduces the building construction technology which is basically the components that a building is comprised of. The course is intended to bring mastery of technology relevant to a simple single storey domestic house. The setting out of a building at the start is introduced and the proper orientation of a building finishes a series of topics in this course. It is hoped that a student should be able to understand how a building is put together and oriented and the relationship between its different components.

Course Code: BUQS1007A**Course Description: Communication Skills****NQF Credits: 12****NQF Level: 5**

The course introduces the students to communication and social responsibility, behaviour, ethics and application in the construction industry; study skills such as effective reading, listening, and effective use of the library resources; critical thinking; plagiarism; students are also taught how to be good communicators by teaching techniques about audience planning, reporting writing and presentation. At the end of the course it is hoped that students will have fundamental principles of both academic and business communication, planning and organising work for specified audiences.

Course Code: BUQS1008A**Course Description: Quantities and Specifications I****NQF Credits: 12****NQF Level: 5**

The course introduces students to the construction industry, its role in the economy, the key stakeholders that make up the industry, and to the role of the quantity surveyor and the standard documents in the project delivery process; the basic principles of building measurement and the tools and protocols used in the measurement of building works.

Course Code: BUQS1009A**Course Description: Real Estate Principles****NQF Credits: 18****NQF Level: 5**

The course assists students to:

identify elements of the built environment and explain environment and explain the needs that drive the built environment; identify and explain the roles of the principal professions that span the conception, design, implementation and operation of the built environment; the characteristics of real estate as an asset, a bundle of rights and a profession (the principal business areas and institutions); understand the nature and characteristics of the real estate markets, the rights inherent in real estate ownership and how these rights can be transferred; and understand the roles of the actors in the real estate sector.

Course Code: BUQS1990A**Course Description: Practical Training****NQF Credits: 0****NQF Level: N/A**

This course requires students to source experiential training in a construction management or construction company for at least two consecutive weeks during or before the winter vacation period. They must observe the activities in the company that relates to the theories that they have learned in the classroom and may be given specific assignments by the company. The students must submit a journal and a report on their experience within two weeks of completion of practical training. The journal must be signed by the work mentor.

Course Code: BUQS1991A**Course Description: Practical Training****NQF Credits: 0****NQF Level: N/A**

This course requires students to source experiential training in a quantity surveying firm or Construction Company for at least two consecutive weeks during or before the winter vacation period. They observe the activities in the company that relates to the theories that they have learned in the classroom and may be given specific assignments by the company. The students must submit a journal and a report on their experience within two weeks of completion of practical training. The journal must be signed by the work mentor.

Course Code: BUQS1992A**Course Description: Practical Experience I****NQF Credits: 0****NQF Level: N/A**

The course provides students with practical experience and exposure to construction processes, technologies, materials, management, ethical issues and construction health and safety. Students are required to source experiential training in a quantity surveying firm or construction company for at least two consecutive weeks during or before the winter vacation period. They must observe the activities in the company that relate to the theories learnt in the classroom and may be given specific assignments by the company. The students must submit journals and reports on their experiences within two weeks of completion of practical training. The journal must be signed by the work mentor.

Course Code: BUQS1993A**Course Description: Practical Experience II****NQF Credits: 0****NQF Level: N/A**

The course provides students with practical experience and exposure to construction processes, technologies, materials, management, ethical issues and construction health and safety.

Course Code: BUQS1994A**Course Description: Practical Experience III****NQF Credits: 0****NQF Level: N/A**

The course provides students with practical experience and exposure to construction processes, technologies, materials, management, ethical issues and construction health and safety.

Course Code: BUQS2003A**Course Description: Building Science I****NQF Credits: 12****NQF Level: 6**

This course provides an introduction to the scientific analysis of the building as a system; an introduction to the factors necessary for design and construction to enable functional, hygienic and safe building environment that enhances human spatial comfort; and key subsystems in buildings.

Course Code: BUQS2004A**Course Description: Construction Technology II****NQF Credits: 12****NQF Level: 6**

This course builds on the content of BUQS2015 Construction Technology I by applying the topics covered for single storey buildings to high-rise buildings, industrial buildings and civil engineering structures. The following topics are introduced: advanced soil investigation and advanced foundations construction functional concepts of fire protection, welding, bolting and riveting are for steel structures; finishes with advanced finishes, cladding, curtain walls and fittings used in high-rise buildings. In modern times there is a strong emphasis on health and safety issues and the students are sensitised to this phenomenon.

Course Code: BUQS2005A**Course Description: Quantities and Specifications II****NQF Credits: 12****NQF Level: 6**

The course builds on the student's knowledge attained in first year to measure and take off quantities for single story standard houses and simple commercial buildings. The same principles are applied to high-rise buildings and the student is taken further in this area by introducing cladding, curtain walls and fittings all for high rise buildings.

Course Code: BUQS2006A**Course Description: Site Management****NQF Credits: 12****NQF Level: 6**

The course imparts knowledge on how the construction site is effectively managed. Topics include: an introduction to the application of relevant management science and concepts to site production process, the site management process, innovations and issues influencing site management practice; imparting knowledge on all types of plant and equipment used in construction; and exposing students to concepts of health and safety and an understanding of the challenges of health and safety in the construction industry.

Course Code: BUQS2008A**Course Description: Accounting Principles in Construction****NQF Credits: 18****NQF Level: 6**

The course introduces students to financial accounting, the basic elements of double entry bookkeeping and to the principles of budgeting and internal control; provides an understanding of the principle financial statements (balance sheet, income statement and cash flow statement) will be sought and covers the financial statements of a sole trader, a partnership, a close corporation and a limited company.

Course Code: BUQS2009A**Course Description: Econometrics for Property Studies****NQF Credits: 18****NQF Level: 6**

The course provides students with a working knowledge of mathematical and statistical tools used in analysing issues in property studies reviewing the following issues: regression and STATA; classical two-variable regression model; properties of estimators; hypothesis testing; multiple regression - estimation, hypothesis testing; multicollinearity; specification error; alternative functional forms; dummy variables; single equation problems of regression- heteroscedasticity, autocorrelation; qualitative choice and limited dependent variable models.

Course Code: BUQS2011A**Course Description: Real Estate Market Analysis****NQF Credits: 18****NQF Level: 6**

The course primarily links discussions of Investment Analysis to Real Estate Development and Real Estate Valuation. It covers: The link between macroeconomic variables and the real estate sector; Defining market area; Productivity analysis; Estimating real estate demand; Estimating supply/GAP; Absorption.

Course Code: BUQS2012A

Course Description: Real Estate Law

NQF Credits: 18

NQF Level: 6

The course focuses on the major concepts, principles and statutes that regulate and govern the negotiation, financing and closing of real estate transactions. Both residential and commercial transactions are discussed and the legal aspects of a transaction - ownership of real property, contract law, types of conveyances, legal descriptions, surveys and plats, ad valorem taxation and financing are emphasised.

Course Code: BUQS2013A

Course Description: Urban Economics

NQF Credits: 18

NQF Level: 6

This course introduces space into economic models and studies the location of economic activity. Urban economics typically addresses four sets of questions, and this course is organised around two out of these four areas. The first set of questions focuses on the development of urban areas (Why do cities exist and why do some grow more rapidly? How can local governments encourage such growth?). The second set of questions addresses patterns of development within metropolitan areas (Why do certain parts of metropolitan areas grow more rapidly than others? How do firms and households decide where to locate within given metropolitan areas? What determines the price of land, and how do these prices vary across space?). Students will be expected to grapple with these questions and apply them to real estate markets.

Course Code: BUQS2014A

Course Description: Real Estate Corporate Finance

NQF Credits: 36

NQF Level: 6

This course covers two decisions faced by an investor - the investment decision and the financing decision. It prepares the student for further studies in real estate valuation, investment and finance by providing a working knowledge of the following issues: time value of money; risk; return and the opportunity cost of capital; asset pricing; capital budgeting and risk; corporate financing and market efficiency; the dividend controversy; Does debt policy matter?; How much should a firm borrow?; financing and valuation; options and option valuation and real options.

Course Code: BUQS2015A

Course Description: Building Technology I

NQF Credits: 18

NQF Level: 6

This course introduces the construction technology needed for single-storey domestic house. Topics include: basic soil investigation; setting out of external and internal foundations, superstructure, walling, arches, fireplaces, roofs and roof coverings, dome roofs, openings (doors and windows), joinery fittings, ironmongery and finishes (walls, floors and ceilings); tools and equipment for simple construction and national building codes and regulations.

Course Code: BUQS3011A

Course Description: Professional and Research Skills

NQF Credits: 12

NQF Level: 7

This course equips students with skills to prepare a research proposal which includes: annotated bibliography; literature reviews and referencing; research topics; problem statements; research questions; academic communication and logical arguments.

Course Code: BUQS3012A**Course Description: Quantities and Specifications III****NQF Credits: 12****NQF Level: 7**

This course focuses on measurement and description of quantities and specifications for specialised facilities such as construction of steel, reinforced concrete in bridges, retaining walls; measurement of civil engineering structures, eg roads, tunnelling, rails, pipelines etc.; measurement of services such as plumbing, drainage and sewers; electrical installation, ventilation and air conditioning, mechanical services and other engineering services; preparation of bills of quantities and use of computer software in preparation of bills of quantities.

Course Code: BUQS3013A**Course Description: Construction Technology III****NQF Credits: 12****NQF Level: 7**

This course is an advanced construction technology course: advanced construction; underpinning and shoring and dome construction; construction of industrial buildings; industrialised buildings; system thinking; mechanised construction; infrastructure and the environment; environmental impact assessment; types of infrastructure; engineering and services; tunnelling; underpinning; road works; bridges; railways; tunnelling and underpinning; subways; pipelines; mining infrastructure; marine works; airports; power stations; bus terminus; train stations; sports infrastructure; health facilities infrastructure; education facilities infrastructure and military facilities infrastructure.

Course Code: BUQS3014A**Course Description: Estimating and Analysis of Prices****NQF Credits: 18****NQF Level: 7**

This course focuses on the following topics: the cost of labour; the all-in hourly rate for labour; the cost of mechanical plant, all-in rate for plant; excavation and filling; concrete, reinforced concrete, formwork; brickwork and blockwork; underpinning, shoring; roof coverings; waterproofing in roofs and foundations; carpentry and joinery; partitions and drywalls; structural steelwork and metalwork; plumbing installations and drainage; finishes to walls, floors, decorative papers and painting; glazing; electrical work; mechanical installations, such as air conditioning, lifts and escalators and tendering and tender strategy.

Course Code: BUQS3015A**Course Description: Management Principles in Construction****NQF Credits: 12****NQF Level: 7**

This course focuses on the following topics: introduction to management concepts to include, evolution of management thought, planning, systems thinking, organising, monitoring and control, communication, leadership, motivation and delegation, including innovative concepts in management; introduction to operations research, critical path scheduling and cost and time optimisation, linear programming, transportation, queuing theory, decision theory and management games; application of these concepts in the construction environment.

Course Code: BUQS3016A**Course Description: Building Science II****NQF Credits: 12****NQF Level: 7**

This course focuses on four topics:

electrical: review of electrical theory; application of electrical theory to installations in domestic dwellings and small commercial buildings; installation methods; electrical protection systems including lighting protection; distribution systems and adherence to the wiring code of practice; acoustics: basic acoustic theory; room acoustics; building acoustics and noise quantification and control; air conditioning: air conditioning theory; difference types of air conditioning systems; calculation loads; specification of systems; and lifts: lifts design and installation.

Course Code: BUQS3018A**Course Description: Introduction to Construction Management****NQF Credits: 12****NQF Level: 7**

The course deals with concepts of construction management namely:

- 1) The project development process: The steps of the development process and economic analysis; Identifying suitable land for development and site appraisal; Market research; Sources of funding.
- 2) Types of funding arrangements for a project development
- 3) The role and functions of a construction management, construction management as a profession versus contracting; Company organisational structures, departments of a construction related companies and their functions.
- 4) Construction planning and business development for construction related companies.

Course Code: BUQS3020A**Course Description: Property Studies****NQF Credits: 12****NQF Level: 7**

In this course the following topics are covered:

- 1) The project development process: The steps of the development process and economic analysis; Identifying suitable land for development and site appraisal; Market research; Town planning requirements that need to be in place before one can start developing; Roles and responsibilities of the professionals in the development process;
- 2) Sources of funding and basic funding arrangements for a property development
- 3) Basic concepts of Money, finance and investment and application to the construction industry, with emphasis on property finance environment, property finance, cash flows and property investment measures.
- 4) The Role of the valuer; Property law and valuation; Legislation affecting the valuation of different types of properties; Finding and using data; The various standards that affect property valuations.
- 5) Income producing property valuations, discounted cash flows and net present value in the property environment.
- 6) Format and structure of an income producing property valuation reports; Using discounted cash flow analysis or income capitalisation to value an income producing property; The capitalisation rate; Approaches that can be used to value special purpose properties
- 7) The course covers the basic principles of property valuations with emphasis on residential property valuations.
- 8) Areas: The Role of the valuer; Property law and valuation; Legislation affecting the valuation of different types of properties; Finding and using data; The theoretical debate in property valuation; The various standards that affect property valuations

Course Code: BUQS3021A**Course Description: Real Estate Management****NQF Credits: 18****NQF Level: 7**

This course covers the description of real estate management profession, managing the office, owner and tenant relations, lease management, maintenance and construction, management of residential, office, retail, and industrial properties, risk and safety management, and environmental issues

Course Code: BUQS3022A**Course Description: Real Estate Valuation****NQF Credits: 18****NQF Level: 7**

This course introduces the student to the Economic Context of Property Valuation and the Property Valuation Profession, Ethics and Conduct. It then presents the five fundamental methods of property valuation which are Comparative Method of Valuation: Theory of comparison, market data collection and analysis; Application: Residential Property Valuation; Income Approach: Traditional valuation and Contemporary approaches to freehold and leasehold interests, DCF models; Application: Commercial Property Valuation, Spreadsheet modeling; Profit Method: Adjustment of financial statements of special trading properties; determination of rental value and/or going-concern value using traditional and DCF approaches. Application: Leisure and, Franchised Property Valuation, Spreadsheet modeling; Cost Method: Replacement and reproduction costs; methods of estimating building costs and depreciation calculations; Application: Non-market Property Valuation, Asset Valuation; and Residual method: valuation of development land, feasibility analysis of development projects. Application: Vacant land valuation, project appraisal, Spreadsheet modeling.

Course Code: BUQS3023A

Course Description: Real Estate Finance

NQF Credits: 18

NQF Level: 7

This course covers the description of the nature and cycles of real estate finance, sources of funds, instruments of financing residential, income-producing real estate, and development land, secondary mortgage markets and alternative financing, legislation relating to real estate lending, processing and closing real estate loans.

Course Code: BUQS3024A

Course Description: Environmental Impact Assessment

NQF Credits: 18

NQF Level: 7

This course introduces the principles, role, purpose, and practice of EIA in decision-making, from the perspective of sustainable development. It exposes students to the process of evaluation and mitigation of the environmental impacts of projects, administration and procedures, and the techniques and tools. It also exposes students to the strengths and limitations of EIA, the framework regulation and practice in South Africa. The systemic view of the relationship between the natural and built environments, as embodied in the concept of sustainable development is central to this course.

Course Code: BUQS3026A

Course Description: Building Services

NQF Credits: 18

NQF Level: 7

This course introduces scientific analysis of the environment as a system; an introduction to environmental concepts of ecology and geology; basic climatology; relationship between the natural and the built environment factors necessary for design and construction to enable functional, hygienic and safe building environment that enhances human spatial comfort; and key subsystems in buildings; energy, lighting, fire protection, water plumbing and drainage; electrical systems, spatial heating and climate control, acoustic control; lifts and escalators

Course Code: BUQS3027A

Course Description: Building Technology II

NQF Credits: 18

NQF Level: 7

This course unpacks the nature of the demand for construction services and the linkages to the wider economy. The construction procurement and project delivery process. Different structural forms; shells, frames and solid buildings, multi-storey buildings, function and constraints on technology choices, health and safety legislation and the responsibilities of clients, knowledge of construction of industrialised buildings and industrialised construction methods and in addition including standardisation and prefabrication, global trends in construction technology and project delivery practices on the work undertaken during the period of vacation employment.

Course Code: BUQS3028A**Course Description: Property Development for Planners****NQF Credits: 18****NQF Level: 7**

This course includes urban and regional planning, urban economics and the property development industry. Topics include: an appreciation of the property development industry in relation to planning and urban development; its size and role in the economy; the structure of the property development industry, its participants and their roles and responsibilities; financing of property developments; relationships between property investment, capital markets and property practices; urban economics and the user market; property development processes; market analysis and feasibility.

Course Code: BUQS4022A**Course Description: Simulated Project****NQF Credits: 17****NQF Level: 8**

This course requires candidates are to integrate all the learning in the programme and provide quantity surveying services using all the rules of professional quantity surveying under supervision based on a real life project. This will include measurement, preparation of bills of quantities, estimating, cost planning and value engineering, pricing of bills of quantities, tendering and tender mitigation, contract administration such as valuations, variations, financial statements and appraisals, and final accounts. In the process, provide professional service using best practices in quantity surveying.

Course Code: BUQS4023A**Course Description: Dispute Resolution****NQF Credits: 17****NQF Level: 8**

This course introduces alternative dispute resolution (ADR), definitions, characteristics of ADR, Benefits, Procedures for ADR; arbitration, mediation, adjudication, Negotiations, expert determination, mini-trials and Fact finding; Remedies and awards

Course Code: BUQS4024A**Course Description: Cost Evaluation and Control****NQF Credits: 17****NQF Level: 8**

This course introduces estimating techniques for projects; Life cycle costing; Developers budget; Cost planning, cost to design and design to cost, cost checks; Value creation in projects and value engineering and management; Preparation of financial appraisals and presentations of financial reports for projects; Implementation of financial controls; Financial effects of time on projects; Sources and uses of data for project cost management.

Course Code: BUQS4025A**Course Description: Advanced Theory and Practice of Quantity Surveying****NQF Credits: 17****NQF Level: 8**

This course equips candidates with the skills to run a Professional Quantity Surveying Practice at various stages of the project, inception, Briefing, design, estimates and feasibility analysis. Documentation, Pricing, Tendering procedures, tender analysis, tender reports, tender adjudication and negotiations. Contract administration under different contracts (e.g. JBCC, FIDIC and NEC).

Valuations, variations, financial appraisals and final accounts; Advanced concepts in practical quantity surveying; Cost engineering and value management, Office practice for a quantity surveying firm.

Course Code: BUQS4026A**Course Description: Construction Law****NQF Credits: 17****NQF Level: 8**

This course equips candidates with a knowledge to navigate through a suite of standard contracts in construction with emphasis on the Joint Building Contract Committee (main and subcontracts) and discussion of articles of agreement. Contractual documents in construction (e.g. Specifications, drawings, and bill of quantities and their contractual implications).

Legislation affecting construction (e.g. Professional Councils Act such as CBE, SACQSP and SACPCMP). The Environmental Act, Health and Safety Act; Industrial relations Act, etc. Advanced and International standard contracts (e.g. FIDIC, NEC and ICE).

Course Code: BUQS4027A

Course Description: Construction Project Management

NQF Credits: 17

NQF Level: 8

This course covers the following:

- 1) The roles and duties of project management in construction;
- 2) The life cycle of the project, inception, feasibility, preconstruction, construction and completion;
- 3) Advanced concepts of project planning; scope, time and cost, construction planning tools;
- 4) Procurement; traditional design and build, construction management, Public private partnerships, other innovative procurement systems;
- 5) Quality management, planning for quality, quality management tools, ISO9000.
- 6) Communication (Communication modules, communication Media in construction);
- 7) Risk Management and Lean Production concepts.

Course Code: BUQS4028A

Course Description: Simulated Project

NQF Credits: 17

NQF Level: 8

This course assists candidates to integrate all the learning in present and previous courses and this course provide construction management services using all the rules of professional construction management under supervision based on a real life project. This will include pretender planning, tendering process, project planning, contract administration, risk management and project commissioning, adhering to professional best practice in construction management.

Course Code: BUQS4029A

Course Description: Advanced Construction Management

NQF Credits: 17

NQF Level: 8

This course covers advanced techniques in construction management.

- 1) These include tendering procedures, pretender arrangements, pretender method statements, preparation of pretender programmes, tender analysis, mark-up and bidding strategies.
- 2) The planning process and tools of planning such as the charts and network analysis; Method statements, planning cash flow, Project control procedures
- 3) Concepts of human resource management including recruitment, appraisal, training and employee relations.
- 4) Employee's health, safety and welfare. Employee participation, involvement and empowerment. Workforce diversity and equality in construction.

Course Code: BUQS4030A

Course Description: Advanced Building Science

NQF Credits: 17

NQF Level: 8

This course introduces candidates to the nature of innovation in the construction industry and its impact on changes in practice in the design and installation of building services. It exposes candidates to the concepts and principles applied in areas such as lighting systems selection and design, IT networks in

buildings, Building Information Modelling (BIM) in facilities management and services coordination and installation. It also explores the benefits, risks and challenges associated with BIM for facilities management; the use of life cycle costing for analysis of building components or sub-systems; and current trends in building services design and installation.

Course Code: BUQS4031A

Course Description: Research Report

NQF Credits: 39

NQF Level: 8

This course introduces candidates to the fundamental principles of academic research, problem identification, literature review, research methods, descriptive, analytical, and experimental. Writing the report, form and style, referencing, plagiarism, ethics in research, preparation of proposal and research project. Candidates must conduct research with a recommended academic supervisor on an appropriate topic of interest in the Built Environment within the school's research framework.

Course Code: BUQS4033

Course Description: Entrepreneurship and Innovation

NQF Credits: 18

NQF Level: 8

This course is about how to create an entrepreneurial business. A key means of achieving this is the business plan – the course will teach candidates how to create one and its importance to attract support and resources from potential investors, manage a growing and necessarily complex set of dynamics by providing mileposts and indicating the resources that will be necessary to achieve them and providing a set of standards against which actual performance can be compared. The course will also teach execution against the plan and flexibility in re-evaluating and changing the plan. The content includes issues such as: Entrepreneurship and Business Plans; Screening entrepreneurial ideas and creating one's own opportunity screen; Applying and adapting classic market research techniques and tools to entrepreneurial business ventures; Start-up business models, the key lessons in business models, how business models have evolved with the internet and the importance of scalability; Sales Strategy & Customer Value Proposition; Financial Models, Projections & Valuations; Product Launch & Go -20 Market Strategies; Start-up dynamics within the founding team - personnel issues in the early phase of a start-up; Presentation Skills and how to handle venture capitalists; Planning for operational success; Scaling a Non-IT business; Basic venture capital structure; aligning the goals of founders and investors.

Course Code: BUQS4034

Course Description: Advanced Real Estate Valuation

NQF Credits: 18

NQF Level: 8

This course covers commercial portfolio property valuation, statutory valuations, valuation of servitudes, agricultural and forest property valuations, mineral land valuations, and valuations of contaminated land

Course Code: BUQS4035

Course Description: Management and Leadership in Property Studies

NQF Credits: 18

NQF Level: 8

This course covers the description of real estate management profession, managing the office, owner and tenant relations, lease management, maintenance and construction, management of residential, office, retail, and industrial properties, risk and safety management, and environmental issues.

Course Code: BUQS4036

Course Description: Commercial Real Estate Investments

NQF Credits: 18

NQF Level: 8

This course provides students with good working and theoretical knowledge of the tools and processes of commercial real estate investment decisions, which finds application in valuation, development and finance.

Course Code: BUQS4037**Course Description: Corporate Real Estate****NQF Credits: 18****NQF Level: 8**

This course examines the acquisition and management of property as an operational asset. It will cover issues like the formulation of integrated corporate real estate strategy, the techniques for operational property management and case study analyses of corporate real estate problems and solutions.

Course Code: BUQS4038**Course Description: Real Estate Development****NQF Credits: 18****NQF Level: 8**

The course presents an overview of the Development Process from planning through acquisition, development, disposal and operation as well as Actors involved, land acquisition strategies, and site Improvements; it covers identification and analysis of land for Development; performing development appraisals and assessing risk; mobilisation of development Finance, application for planning permission; monitoring the construction process; undertaking Market Research, Promotion and Selling or letting; it also incorporate Green Development

Course Code: BUQS4039**Course Description: Facilities Management****NQF Credits: 18****NQF Level: 8**

Facilities management is the total management of all real estate related services that support the core business of an organisation. The purpose of the course is enable students serve in professional roles that promote the efficiency and productivity of a company, its staff and even its clients, while reducing the company's operating costs. The course will cover the scope and definitions of facilities management; FM strategy and the outsourcing decision; Managing outsourced and in-house services; Specifying services and supplies; Selecting service providers and suppliers; Managing and improving performance; Partnerships and long-term projects.

Course Code: BUQS4040**Course Description: Advanced Real Estate Market Analysis****NQF Credits: 18****NQF Level: 8**

The overall aim of this course is to provide students with good working knowledge of:

The course covers topics such as: Market Analysis – definition, components; Real Estate Economics; Metropolitan growth patterns; Analysing metropolitan economies; Residential market analysis - Macro and micro level; Office analysis - Macro and micro level; Retail market analysis - Macro and micro level; Industrial market analysis - Macro and micro level.

- 1) How real estate markets function at the macroeconomic/metropolitan level and at the more narrow/microeconomic/site level
- 2) How to go about analysing in a meaningful way different real estate markets for development, investment and/or valuation purposes.
- 3) After the course, participants should be able to (individually and in groups):
- 4) Describe the market analysis process and explain the reasons for it
- 5) Explain the different theories of urban growth and use them to analyze the relocation choice of a hypothetical company
- 6) Analyze the growth of a given metro and offer advice on which asset classes are likely to be affected by metro growth
- 7) Estimate demand and supply gaps for different asset classes
- 8) Use micro-level analysis of the different asset classes to forecast prices, rents and absorption
- 9) Use market analysis for different property types to give investment advice

Course Code: BUQS4041**Course Description: Research Report****NQF Credits: 36****NQF Level: 8**

Introductory lectures for Introduction to research, problem identification, literature review, research methods, descriptive, analytical, and experimental. Writing the report, form and style, referencing, plagiarism, ethics in research, preparation of proposal and research project. Candidates to undertake research with a recommended academic supervisor on an appropriate topic of interest in the Built Environment within the school's research framework.

Course Code: BUQS5013A**Course Description: Real Estate Law****NQF Credits: 12****NQF Level: 8**

This course focuses on the major legal concepts, principles and statutes that regulate and govern the negotiation, financing and closing of real estate transactions. Both residential and commercial transactions will be discussed. The emphasis will be on the legal aspects of a transaction: ownership of real property, contract law, types of conveyances, and legal descriptions. Default and the process of foreclosure will be covered.

Course Code: BUQS5014A**Course Description: Real Estate Market Analysis****NQF Credits: 12****NQF Level: 8**

The course covers the following topics: The link between macroeconomic variables and the real estate sector; Defining market area; Productivity analysis; Estimating real estate demand; Estimating supply/GAP; Absorption.

Course Code: BUQS5015A**Course Description: Real Estate Valuation****NQF Credits: 18****NQF Level: 8**

The course covers the following topics: Property investors – public/private. Property markets/property management. Intermediaries. Type of property investments– leasebacks/share block/sectional title/residential/commercial/industrial. Professional bodies, building societies, estate agents etc. Building by-laws. Construction techniques.

Course Code: BUQS5016A**Course Description: Quantitative Methods for Property Studies****NQF Credits: 18****NQF Level: 8**

The course is intended to help candidates develop working knowledge of the quantitative tools used in different areas of the real estate discipline. It also begins training for tools they will eventually use in conducting research. It covers descriptive statistics and inferential statistics (sampling distributions and hypothesis testing), multiple regression and logistic regression analysis with examples drawn from real estate and using real estate data.

Course Code: BUQS5017A**Course Description: Commercial Real Estate Investments****NQF Credits: 18****NQF Level: 8**

The course covers the following topics: Real estate as an asset class; The concept of investments; Real estate investment evaluation process; Market analysis; Measuring Real estate returns; Cash flow proformas and discount rates; Financial leverage in real estate; Alternative sources of financial and non-financial resources; After-tax investment analysis; Real estate investment capital structure; Excel modelling of real estate investments.

Course Code: BUQS5018A**Course Description: Applied Macroeconomics****NQF Credits: 18****NQF Level: 8**

This course applies macroeconomic principles and theories to analysing property markets for the purposes of making investment decisions and also valuing property. It covers topics such as: Macroeconomic measurement and performance; The goods Market; Monetary sector and Monetary Policy; Goods and Financial Markets - the IS-LM Model; The links between the Business Cycle and Real Estate Cycles. Financial and Property Crises.

Course Code: BUQS5019A**Course Description: Real Estate Finance****NQF Credits: 12****NQF Level: 8**

The course covers the description of the nature and cycles of real estate finance, sources of funds, instruments of financing residential, income-producing real estate, and development land, secondary mortgage markets and alternative financing, legislation relating to real estate lending, processing and closing real estate loans.

Course Code: BUQS5020A**Course Description: Real Estate Development****NQF Credits: 12****NQF Level: 8**

This course covers: Overview of the Development Process and Actors; Land Acquisition; and Site Improvements; Land for Development; Development Appraisal and Risk; Development Finance; Planning; Construction; Market Research; Promotion and Selling; Green Development.

Course Code: BUQS5021A**Course Description: Law for Property Development and Management I****NQF Credits: 10****NQF Level: 8**

The focus of this course is on the major legal concepts; principles and statutes that regulate and govern the negotiation; financing and closing of real estate transactions. Both residential and commercial transactions will be discussed. The emphasis will be on the legal aspects of a transaction: ownership of real property; contract law; types of conveyances; legal descriptions; surveys and plats; ad valorem taxation and financing. Default and the process of foreclosure will be covered.

Course Code: BUQS5022A**Course Description: Law for Property Development and Management II****NQF Credits: 10****NQF Level: 8**

The purpose of this course is to equip candidates with in depth knowledge of the legal and legislative framework that impacts upon the property environment. Candidates will learn about the principles of revenue and capital gains tax and the impact upon property investment decisions and how to plan a tax efficient property investment strategy. Candidates will learn about the various ownership vehicles that can be used to own property. Candidates will also learn about the legal principles relating to corporate governance.

Course Code: BUQS5023A**Course Description: Real Estate Market Analysis****NQF Credits: 10****NQF Level: 8**

The course covers: The link between macroeconomic variables and the real estate sector; Defining market area; Productivity analysis; Estimating real estate demand; Estimating supply/GAP; Absorption.

Course Code: BUQS5024A**Course Description: Real Estate Valuation****NQF Credits: 10****NQF Level: 8**

This course introduces candidates to the Economic Context of Property Valuation and the Property Valuation Profession; Ethics and Conduct. It then presents the five fundamental methods of property valuation which are:

- 1) Residential Real Estate Valuation Theory and Application- market data collection and analysis: variable selection and comparable identification; Factor analysis and valuation reporting.
- 2) Commercial Real Estate Valuation: Traditional valuation of freehold and leasehold interests; provision for ASF; Initial yield analysis; selection of yield for discounting;
- 3) Contemporary approaches: equated yield; implied growth; explicit cash flow models; Valuation of Going-Concerns: Adjustment of financial statements of special trading properties; determination of rental value and/or going-concern value using the dual capitalisation; total earnings capitalisation and DCF of Earnings. Spreadsheet modelling and Software application.
- 4) Non-market Real Estate and Asset Valuation: Replacement and reproduction costs; methods of estimating building costs - Comparative Unit; Unit-in-place (segregated Cost) and Quantity Surveyors' methods; depreciation: double-declining; straight line; sum-of-year digit; Application.
- 5) Development Appraisals and land Valuation: valuation of development land; feasibility analysis of development projects. Application: Vacant land valuation; project appraisal; Spreadsheet modelling and Argus Developer ® Software.
- 6) International valuation standards; statutory valuations including municipal mass valuations and valuations for expropriation purposes; Valuation of servitudes; and agricultural property valuations.

Course Code: BUQS5025A**Course Description: Quantitative Methods for Property Studies****NQF Credits: 20****NQF Level: 8**

The course is intended to help candidates develop working knowledge of the quantitative tools used in different areas of the real estate discipline. It also begins training for tools they will eventually use in conducting research. It covers descriptive statistics and inferential statistics (sampling distributions and hypothesis testing); multiple regression and logistic regression analysis with examples drawn from real estate and using real estate data.

Course Code: BUQS5026A**Course Description: Commercial Real Estate Investments****NQF Credits: 10****NQF Level: 8**

The course covers the following topics: Real estate as an asset class; The concept of investments; Real estate investment evaluation process; Market analysis; Measuring Real-estate returns; Cash flow proformas and discount rates; Financial leverage in real estate; Alternative sources of financial and non-financial resources; After-tax investment analysis; Real estate investment capital structure; Excel modelling of real estate investments.

Course Code: BUQS5027A**Course Description: Applied Macroeconomics****NQF Credits: 10****NQF Level: 8**

This course applies macroeconomic principles and theories to analysing property Markets for the purposes of making investment decisions and also valuing property. It covers topics such as: Macroeconomic measurement and performance; the goods Market; Monetary sector and Monetary Policy; Goods and Financial Markets - the IS-LM Model; The links between the Business Cycle and Real Estate Cycles. Financial and Property Crises.

Course Code: BUQS5028A**Course Description: Real Estate Finance****NQF Credits: 10****NQF Level: 8**

The course covers the description of the nature and cycles of real estate finance; sources of funds; instruments of financing residential; income-producing real estate; and development land; secondary mortgage markets and alternative financing; legislation relating to real-estate lending; processing and closing real estate loans.

Course Code: BUQS5029A**Course Description: Real Estate Development****NQF Credits: 10****NQF Level: 8**

This course is an overview of the Development Process and Actors; Land Acquisition; and Site Improvements; Land for Development; Development Appraisal and Risk; Development Finance; Planning; Construction; Market Research; Promotion and Selling; Green Development.

Course Code: BUQS5030A**Course Description: Real Estate Brokerage****NQF Credits: 10****NQF Level: 8**

The purpose of Real Estate Brokerage is to provide candidates with working knowledge of real estate brokerage. After the course; candidates should be able to:

The course will cover: The brokerage function; The economic rationale for hiring a broker; Types of Brokerage Relationships; Licensing and certification of brokers; The Marketing function; Types of listing contracts; Listing contract provisions; Asymmetric information and real estate brokerage contracts

- 1) Describe the brokerage function and explain the reasons sellers use brokers
- 2) Explain the real estate licensing process in the South African context
- 3) Differentiate between licensing and certification in the South African context
- 4) Explain how commission rates are determined
- 5) List; describe and analyse listing contracts
- 6) Describe and analyse agency relationships in real estate brokerage and the impact of asymmetric information on the agency relationship
- 7) Explain the protective provisions for a property owner and broker that should be included in a listing contract
- 8) Explain the ways that a listing contract can be terminated

Course Code: BUQS5031A**Course Description: Real Estate Development****NQF Credits: 10****NQF Level: 8**

This course is an overview of the Development Process and Actors; Land Acquisition; and Site Improvements; Land for Development; Development Appraisal and Risk; Development Finance; Planning; Construction; Market Research; Promotion and Selling; Green Development.

Course Code: BUQS5032A**Course Description: Management and Leadership for the Property Sector****NQF Credits: 20****NQF Level: 8**

This course formalises the development of leadership skills of participants in preparation to entering the property sector. The course covers the following topics:

- 1) Managerial Roles and Competencies.
- 2) Self-Awareness: Emotional Foundations of Personal Growth
- 3) Self-Awareness: Developing Self Awareness

- 4) Self-Awareness: Tools for Reflection
- 5) Self-Awareness: Stress Management
- 6) Problem-Solving Skills for Managers
- 7) Communication Skills
- 8) Managerial Power and Influence
- 9) Motivation Techniques and Performance Improvement I
- 10) Motivation Techniques and Performance Improvement II
- 11) Managing Conflict
- 12) Empowering and Delegating
- 13) Working in and Leading Effective Teams

Course Code: BUQS5033A

Course Description: Introduction to Facilities Management

NQF Credits: 20

NQF Level: 8

The course primarily provides an introduction to the concept of facilities management. The role of the facilities manager in a corporate organisation; Business management techniques applicable in FM; Goals and benefits of Facilities Management; Environmental and economic issues in Facilities Management. Professional development and trends in Facilities Management; Case studies and research methods applicable to Facilities Management application in South Africa

Course Code: BUQS5034A

Course Description: Building Services

NQF Credits: 20

NQF Level: 8

This course focuses on understanding new building systems and their impacts upon people and the workplace at a high level of competency. This course will cover the technical and managerial aspects of the different building systems as well as the role and application of computer programs to assist. This overview will then be nested across the requisite skills; competence; and competencies of a facilities manager as drawn from international best practices; communities of practices; and existing body of knowledge. It will cover: energy in buildings (e.g.; heating ; ventilation; and air-conditioning (HVAC); lighting and electrical systems); environmentally responsible design and construction (i.e. sustainable buildings); integrated building technology; total building performance and integration; building materials and maintainability of buildings; building automation (including building information modelling); space programming and environmental psychology. These topics will be underpinned by international and local case studies to reinforce learning for the candidates.

Course Code: BUQS5035A

Course Description: Strategic Planning

NQF Credits: 20

NQF Level: 8

The course primarily focuses on strategies for management to anticipate and accommodate change in corporate-wide facilities. Areas of discussion include the planning framework; establishing goals; developing linkage between business planning and facilities planning; methods for information gathering; building an information database; inventory and needs analysis; modelling techniques; developing an action policy and effective communication of facilities issues to senior management

Course Code: BUQS5036A

Course Description: Commercial/Procurement Law

NQF Credits: 20

NQF Level: 8

The course primarily focuses on laws on employees and contract law as well as property law.

Course Code: BUQS5037A**Course Description: Space and Workplace Management****NQF Credits: 20****NQF Level: 8**

The course outlines the key issues related to managing the spatial resource of organisations. This includes operational issues such as: the development of space standards; relocation management and space planning.

Course Code: BUQS5038A**Course Description: Information Technology in Facilities Management****NQF Credits: 20****NQF Level: 8**

The course covers primarily Mobile growth; fixed network need; Bluetooth; WIMAX; voice becomes data; Wi-Fi zones; IT infrastructure management; intelligent buildings; future proofing; cabling categories; Voice on internet protocols; development in IP telephony; conferencing and presentation technology; E-commerce; helpdesks; digital versus paper document systems; use of IT software such as Computer Aided Facilities Management; Building information Modelling; Computer Maintenance Management Software; Estates master and so on

Course Code: BUQS5039A**Course Description: Project Management****NQF Credits: 20****NQF Level: 8**

This course focuses on the discrete; yet overlapping; roles of project management and facilities management. While project management could include facilities management; facilities management must include project management. This course will cover an overview of project management from the initiating phase to closing phase of a construction project. This overview will then be nested across the requisite skills; competence; and competencies of a facilities manager as drawn from international best practices; communities of practices; and existing body of knowledge. It will cover: managing of integration; scope; time; cost; quality; human resource; communications; risk; procurement; stakeholder; HSE (health; safety; and environment); finances and claims; the core competencies of FM using the FM Pie; international and local case studies of project management in facilities management.

Course Code: BUQS5040A**Course Description: Environmental Management****NQF Credits: 20****NQF Level: 8**

The course primarily focuses on the management of energy and other sustainability issues. This includes issues on Environmental protection; environmental regulations such as climate change compliance; carbon foot printing and environmental management accreditation schemes and waste management.

Course Code: BUQS5041A**Course Description: Occupational Health and Safety****NQF Credits: 20****NQF Level: 8**

The course primarily focuses on cost of poor health; health and safety laws; enforcement regulations; health and safety leadership; risk assessment; spotting hazards; HSE steps to risk assessment; criminal sanctions; compensation; promotion of occupational health; manual handling; accidents and incidents; improving well-being; sick building syndrome; safety in the workplace; flexible working; construction work and building management; managing contracts health and safety; fire risk assessment; disability management; catering facilities.

Course Code: BUQS5042A**Course Description: Advanced Facilities Management****NQF Credits: 20****NQF Level: 8**

This course will cover issues on laws on employees and contract law as well as property law

Course Code: BUQS7009A

Course Description: Research Methodology

NQF Credits: 20

NQF Level: 9

This course covers: Philosophy of research; Research designs and Proposals; Data generation Ethics; Report Writing Descriptive Statistics; Statistical inference; using statistical packages.

Course Code: BUQS7022A

Course Description: Construction Law and Contract Management

NQF Credits: 20

NQF Level: 9

The course equips candidates with an understanding of the legal and organisational frameworks that govern the commercial processes of structuring; negotiating; recording and enforcing contracts and business deals in construction and civil engineering across a range of standard forms and conditions of contract whilst operating both in SA and international jurisdictions. The curriculum will cover how the current; common standard construction contracts (e.g. FIDIC; NEC GCC etc.) evolved the placement of construction contracts in the context of negotiation and tendering processes the obligations of the contractor and the employer under standard contracts the legal positions of specialist trade contractors and by contract administrators the circumstances and processes for determination of contracts and decide on the appropriate remedies for breach of contract the administering and management of the basic principles associated with contractual claims the range and appropriate selection of dispute settlement procedures including arbitration and litigation.

Course Code: BUQS7024A

Course Description: Project Management

NQF Credits: 20

NQF Level: 9

This course examines the ongoing dynamic and complexity regarding the management of projects. It will also briefly consider the role and value of human resources in projects. Assessment will be by a single item of coursework. Preparation for the coursework will include a structured programme of directed learning; involving student-led discussions and debates regarding papers published in project management-related refereed journals.

Course Code: BUQS7025A

Course Description: Construction Planning and Control

NQF Credits: 20

NQF Level: 9

This course covers the following topics:

- 1) Managerial Roles and Competencies.
- 2) Value & Risk appraisal: Introduction to Risk Management; Risk Management cycle; Evaluation of risk analysis and management systems; Value Management- Introduction to value management. Value management in practice- Analysis of value management systems.
- 3) Procurement management: Introduction to various procurement methods; Partnering and Alliancing; Corporate Teaming Arrangements; Transaction Cost analysis and Procurement Risks.
- 4) Integration & Interface management: Introduction to site interface management; Introduction to Design management; Introduction to Lean principles; Document Management systems. IT application in Interface and Document Management. Building Information Modelling applications in project planning and control.

Course Code: BUQS7026A

Course Description: Construction Economics and Finance

NQF Credits: 20

NQF Level: 9

This course focuses on:

- 1) Basic concepts of economic analysis; feasibility studies and evaluation of alternative engineering projects for capital investment.
- 2) Consideration of time value of money and common merit measures such as net present value; Rate of Return (ROR) and Internal Rate of Return (IROR).
- 3) Capital budgeting and project financing. Important factors affecting investment decisions for private and public projects. Loans to Contractors; Interim construction financing. Uncertainty and risk in operation and financing.
- 4) Influence of price level changes; depreciation and taxation on choice of alternatives. Financial documents and Balance sheet management. Cash basis of an accounting; Accrual basis of accounting; Percentage completion method; Completed contract method; Accounting for tax reporting purposes and financial reporting purposes; Accounting Standards. Value and Client Management techniques.

Course Code: BUQS7028A

Course Description: Real Estate Finance

NQF Credits: 10

NQF Level: 9

The course covers the description of the nature and cycles of real estate finance; sources of funds; instruments of financing residential; income-producing real estate; and development land; secondary mortgage markets and alternative financing; legislation relating to real estate lending; processing and closing real estate loans.

Course Code: BUQS7029A

Course Description: Real Estate Development

NQF Credits: 10

NQF Level: 9

This course covers the following topics: Management Overview of the Development Process and Actors; Land Acquisition; and Site Improvements; Land for Development; Development Appraisal and Risk; Development Finance; Planning; Construction; Market Research; Promotion and Selling; Green Development.

Course Code: BUQS7030A

Course Description: Real Estate Market Analysis

NQF Credits: 10

NQF Level: 9

This course introduces candidates to the theories and methods used in analysing real estate markets for development and valuations. The course covers: The link between macroeconomic variables and the real estate sector; Defining market area; Productivity analysis; Estimating real estate demand; Estimating supply/GAP; Absorption

Course Code: BUQS7031A

Course Description: Real Estate Law

NQF Credits: 10

NQF Level: 9

This course focuses on the major legal concepts; principles and statutes that regulate and govern the negotiation; financing and closing of real estate transactions. Both residential and commercial transactions will be discussed. The emphasis will be on the legal aspects of a transaction: ownership of real property; contract law; types of conveyances; legal descriptions; surveys and plats; ad valorem taxation and financing. Default and the process of foreclosure will be covered.

Course Code: BUQS7032A

Course Description: Property Valuation

NQF Credits: 10

NQF Level: 9

This course introduces the candidate to the Economic Context of Property Valuation and the Property Valuation Profession; Ethics and Conduct. It then presents the five fundamental methods of property valuation which are:

- 1) Comparative Method of Valuation: Theory and Application- market data collection and analysis: variable selection and comparable identification; Factor adjustment – direct factor adjustment; simultaneous equation; linear programming; single and multiple regressions. Application: Residential Property Valuation Income Approach: Traditional valuation of freehold and leasehold interests; provision for ASF; Initial yield analysis; selection of yield for discounting; Contemporary approaches: equated yield; implied growth; explicit cash flow models; Application:
- 2) Commercial Property Valuation; Spreadsheet modelling and Argus Valuation DCF ® Software
- 3) Profit Method: Adjustment of financial statements of special trading properties; determination of rental value and/or going-concern value using the dual capitalisation; total earnings capitalisation and DCF of Earnings. Application: Leisure and; Franchised Property Valuation; Spreadsheet modelling and Argus Valuation DCF ® Software Cost Method (Contractor's Test): Replacement and reproduction costs; methods of estimating building costs - Comparative Unit; Unit-in-place (segregated Cost) and Quantity Surveyors' methods; depreciation: double-declining; straight line; sum-of-year digit; Application. Application: Non-market Property Valuation; Asset Valuation Residual method: valuation of development land; feasibility analysis of development projects. Application: Vacant land valuation; project appraisal; Spreadsheet modelling and Argus Developer ® Software
- 4) International valuation standards; commercial portfolio property valuation; Statutory valuations including municipal mass valuations and valuations for expropriation purposes; Valuation of servitudes; and agricultural property valuations

Course Code: BUQS7033A

Course Description: Applied Macroeconomics

NQF Credits: 10

NQF Level: 9

This course applies macroeconomic principles and theories to analysing property Markets for the purposes of making investment decisions and also valuing property. It covers topics such as: Macroeconomic measurement and performance; the goods Market; Monetary sector and Monetary Policy; Goods and Financial Markets - the IS-LM Model; The links between the Business Cycle and Real Estate Cycles. Financial and Property Crises.

Course Code: BUQS7034A

Course Description: Advanced Topics in Real Estate Studies

NQF Credits: 10

NQF Level: 9

This course assists candidates in preparing for the dissertation in a structured way by helping them find; scope out a topic (if they don't already have one) and formulate their own research problem based on the topic. It also meant to provide them with some generic skills in research writing; in addition to helping them develop insights into research issues connected to the different courses in the program. The course thus has a dual purpose: learning to write up research and writing to learn about a research issue of the candidate's own choice.

The course has two components:

- 1) One focuses on deepening the skills in reading; analysing scientific papers as well as writing that will be taught during the disciplinary courses, topics include: the research process; literature search; critical analysis of source material; topic selection; writing in the context of research; problem formulation; avoiding plagiarism.
- 2) The other with research issues in real estate studies and consists of seminars on research topics. Parts 1 and 2 will run almost simultaneously.

Course Code: BUQS7035A

Course Description: Commercial Real Estate Investments

NQF Credits: 10

NQF Level: 9

The course covers the following topics: Real estate as an asset class; The concept of investments; Real estate investment evaluation process; Market analysis; Measuring Real estate returns; Cash flow proformas and discount rates; Financial leverage in real estate; Alternative sources of financial and non-financial resources; After-tax investment analysis; Real estate investment capital structure; Excel modelling of real estate investments.

Course Code: BUQS7036A

Course Description: Quantitative Methods for Property Studies

NQF Credits: 20

NQF Level: 9

The course assists candidates develop working knowledge of the quantitative tools used in different areas of the real estate discipline. It also begins training for tools they will eventually use in conducting research. It covers descriptive statistics and inferential statistics (sampling distributions and hypothesis testing); multiple regression and logistic regression analysis with examples drawn from real estate and using real estate data.

Course Code: BUQS7037A

Course Description: Construction Safety and Quality Management

NQF Credits: 20

NQF Level: 9

This course focuses on various theories and practices of construction safety and quality management, in line with international and national standards. The course introduces candidates to construction safety and health, importance of jobsite safety, occupational Health in Construction, theory of Accidents, and the management of safety and health in construction through the lens of risk management, ISO 9001 principles, OHSAS 18001 principles, and the SACPCMP skills modules for Construction Health and Safety in Construction projects Stages 1 - 6. The course also introduces candidates to the concept of quality including product and process quality, and quality culture. It introduces students to the principles and application of construction quality management, total quality management, tools and techniques for quality, and an introduction to the ISO 9001:2000 and its principles and procedures.

SCHOOL OF ECONOMIC AND BUSINESS SCIENCES

Course Code: ECON1002A

Course Description: Economic Concepts IA

NQF Credits: 18

NQF Level: 5

Microeconomics: The economic problem; demand and supply; market equilibrium; elasticity of demand and supply; markets in action; utility and demand; production and costs; market structures and factor markets.

Course Code: ECON1003A

Course Description: Economic Concepts IB

NQF Credits: 18

NQF Level: 5

The courses develop and extend knowledge of concepts covered in Economic Concepts IA. It also develops the theoretical basis for entry into Economic Studies II. Course content includes: consumer theory and price theory; market structure; international economics; Keynesian aggregate demand and aggregate supply theory; fiscal and monetary policy; theories of migration; human capital; labour market discrimination; growth and development; and trade integration.

Course Code: ECON1012A/ECON1013A (PT)

Course Description: Economics IA - Microeconomics

NQF Credits: 18

NQF Level: 5

This course introduces students to the core microeconomic theory. The course investigates the optimising behavior of both consumers and firms and the coordination of their decisions through markets. It takes a technical (mathematics based) approach to exploring the theory and applies this knowledge to explaining real world social issues in South Africa and abroad. The primary focus of the course is to develop an understanding of the theory and underlying logic of the economic models that form the core of the discipline. The topics covered include: economic efficiency; demand and supply; utility theory; firm cost, production, and output decisions; pricing and allocation of factors of production; market structures; international trade; and applied market analysis.

Course Code: ECON1014/ ECON1015A (PT)

Course Description: Economics IB - Macroeconomics

NQF Credits: 18

NQF Level: 5

This course introduces students to core macroeconomic theory. The course investigates the phenomenon of economic growth and its fluctuation, and considers the roles of both fiscal and monetary policy in this process. It takes a technical approach to exploring the theory and applies this knowledge to explaining real world social issues in South Africa and abroad. The primary focus of the course is to develop an understanding of the theory and underlying logic of the economic models that form the core of the discipline. The topics covered include: measuring output, unemployment, and inflation; the business cycle; the aggregate expenditure, aggregate demand and aggregate supply; and ISLM models; fiscal and money policies, banks and interest rates determination; the balance of payments; and applied economic growth analysis.

SCHOOL OF ELECTRICAL AND INFORMATION ENGINEERING

Course Code: ELEN1003A

Course Description: Critical Thinking

NQF Credits: 12

NQF Level: 5

(12) (1 -1-0) (2 terms)

This course will enable students to think critically through the development of logical arguments, reading and comprehending material with advanced critical literacy and applying imaginative responses to problems.

Course Code: ELEN1998A

Course Description: Vacation Work I (Electrical)

NQF Credits: 0

NQF Level: N/A

The first period of vacation work should be completed during a period of six consecutive weeks in the year succeeding that in which credit is obtained for second year. Where possible the vacation work should take place in an industrial environment; and should be according to the departmental guidelines for vacation work as described in the CB&O. A student may undertake an alternative approved programme involving community work; work in developing areas or appropriate technology. Proposals must be submitted to the course coordinator by 1 September of each year for approval of the programme by the Head of School. The requirements for satisfactory completion of vacation work are the submission of a vacation work certificate confirming that students have completed their work regularly and satisfactorily during the prescribed period and a report on the work undertaken during the period of vacation employment meeting the criteria described in the CB&O.

Course Code: ELEN1999A

Course Description: Vacation Work II (Electrical)

NQF Credits: 0

NQF Level: N/A

The second period of vacation work should be completed during a period of six consecutive weeks in the year succeeding that in which credit is obtained for third year. Where possible the vacation work should take place in an industrial environment and should be according to the departmental guidelines for vacation work as described in the CB&O. A student may undertake an alternative approved programme involving community work; work in developing areas or appropriate technology. Proposals must be submitted to the course coordinator by 1 September of each year for approval of the programme by the Head of School. The requirements for satisfactory completion of vacation work are the submission of a vacation work certificate confirming that students have completed their work regularly and satisfactorily during the prescribed period and a report on the work undertaken during the period of vacation employment meeting the criteria described in the CB&O.

Course Code: ELEN2000A

Course Description: Electrical Engineering

NQF Credits: 18

NQF Level: 6

(18) (4-1-1) (2 term)

This course provides a broad yet fundamental understanding of electrical engineering concepts. Students learn how to analyse simple ac; dc and transient circuits as well as basic concepts of electronics. The students are also introduced to concepts of power engineering ranging from the single phase transformer, to the three-phase circuits and the dc and three-phase induction machine. The course entails three key areas:

- 1) Circuit analysis methods and tools
- 2) Basic electronics
- 3) Concepts of power engineering

Course Code: ELEN2003A

Course Description: Electric and Magnetic Systems

NQF Credits: 18

NQF Level: 6

(18) (4-1-0.5) (2 term)

This is an introductory course into the application of electric-and magnetic-fields in engineering systems. It builds on first year courses in physics and electric circuits to provide a general foundation in the engineering science. The course provides an introduction into:

- 1) The coupling and energy conversion characteristics of electric-and magnetic-fields
- 2) Simple electro-magnetic wave propagation; and the principles of electricity supply and tariffs

Course Code: ELEN2020A

Course Description: Software Development I

NQF Credits: 16

NQF Level: 6

(16) (4-1-1) (2 term)

This course is an introduction to computing. A history of computing from 1940 to today. Introduction to computer hardware architecture and software concepts. Representing data in computers – number systems and the ASCII code. Computer language concepts (data types; flow of control; structuring mechanisms). Programming in C + +. Introduction to OO programming and concepts. Classes and objects. Programming project.

Course Code: ELEN2005A

Course Description: Signals and Systems I

NQF Credits: 12

NQF Level: 6

(12) (2-1-0.5) (2 term)

The Signals and Systems I course will provide students with the competencies needed to mathematically use time and frequency domain techniques to model and analyse signals and systems and to calculate the response of linear time invariant (LTI) systems. The course aims to give students an understanding of how to apply their signal analysis techniques in real-world engineering problems.

The course topics include:

- 1) Mathematical models in terms of dependent and independent variables and as a function of time;
- 2) Modelling linear time-invariant systems and circuits in terms of differential equations;
- 3) Computation of LTI system responses using differential equations; two-dimensional plots and convolution;
- 4) Laplace Transforms for analysis of the frequency domain;
- 5) Zero-input and zero-state responses;
- 6) System stability;
- 7) Resonance;
- 8) Network synthesis; two-port networks; and system interconnections;
- 9) Fourier series; and
- 10) Maximum power transfer.

Course Code: ELEN2006A

Course Description: Microprocessors

NQF Credits: 14

NQF Level: 6

(14) 2-1-1) (1 term)

This course focuses on the following topics:

Binary mathematics: Conversion between bases. Fixed point operations. Floating point operations.

Microcontroller fundamentals: Architecture. Memory addressing and management. Processing schemes (real time; interrupt driven). Programming devices Microcontroller components Registers. Multipliers. Dividers. EUSART module. PWM module. CPU. Combinational and Sequential logic: Decoders/Encoders. Multiplexers. Adders; comparators and multipliers. Registers; shift registers and converters.

Course Code: ELEN2016A/ELEN2018A (PT)

Course Description: Electronics I

NQF Credits: 16

NQF Level: 6

(16) (3-1-1) (2 term)

This is the first course in Electronics. It familiarise the student with the appropriate underlying vocabulary and provides a good basic understanding of different basic analogue and digital electronic devices, their applications and limitations. The course is anchored in analysis and design of basic electronic circuits. The course seeks to inculcate proper design approach of electronic circuits through laboratory experimentation and project work. Topics covered are: diodes bipolar junction transistors; field effect transistors, op-amps and logic circuits.

Course Code: ELEN2017A/ELEN2019A (PT)

Course Description: Electric Circuits

NQF Credits: 12

NQF Level: 6

(12) (3-0-1) (1 term)

This course provides students with the competencies for basic electrical circuit analysis. It gives students an understanding of fundamental circuit laws and how to apply these to analyse any electrical circuit. The course includes the following topics: operational amplifiers; basic electrical concepts; including voltage; current; energy; power and resistance; basic waveforms; energy and power; network theorems and laws;

including ohm's law; Kirchoff's voltage and current laws; series and parallel resistors; voltage and current divider laws; systematic circuit analysis; including node voltage and mesh current analysis; superposition theorem; electrical measurements using an oscilloscope; signal generator and digital multimeter; Thevenin and Norton equivalent circuits; maximum power transfer in resistive circuit; and inductor and capacitors.

Course Code: ELEN3000A

Course Description: Electromagnetic Engineering

NQF Credits: 12

NQF Level: 7

(12) (3-1-1) (1 term)

Transmission Lines: Introduction; infinite transmission line; terminated transmission line; input impedance; stand and travelling waves; VSWR; power flow.

Smith Chart: Development; use; matching-single and double stub. Scattering parameters.

Static Fields: Basic revision of electric fields; flux; duality; field plotting.

Maxwell's Equations: For plane waves; boundary conditions-conductors and dielectrics; Depth of penetration; skin depth.

Antennas: Basic radiation fundamentals; launching and receiving radiating waves.

Applications: EMC; shielding effectiveness; remote sensing; waveguides.

Course Code: ELEN3002A

Course Description: Electronics II

NQF Credits: 15

NQF Level: 7

(15) (3-1-1) (1 term)

This course will provide the competencies to design and analyse a wide range of electronic systems. The emphasis is on dealing with design and analysis from a fundamental point of view; especially how to deal with new unseen devices and unknown systems. This course focuses on the following:

- 1) Basics of modelling electronic components.
- 2) Modelling of passive components.
- 3) Circuit design and analysis.
- 4) Dealing with complexity.

Course Code: ELEN3003A

Course Description: Power Engineering

NQF Credits: 15

NQF Level: 7

(15) (3-1-2) (1 term)

This course focuses on the following topics:

- 1) Three Phase Transformers: Three Phase Transformer connections. Phase shift. Equivalent circuit. Per unit notation and transformers in parallel
- 2) Basic Machine Theory: Emf generation in machines. Distribution; coil span and winding factors. Mmf developed by distributed windings. Development of rotating fields. Torque developed. Simple AC windings (integral slot).
- 3) Induction Motor: Development of a phasor diagram for starting and running conditions. Development of equivalent and approximate equivalent circuits. Current and torque characteristics. Rotor resistance variation and deep bar effects. Methods of starting and speed control.
- 4) Synchronous Machine: Development of phasor diagram for cylindrical synchronous machines. Concept of synchronous reactance. Short circuit ratio. Operation as an isolated generator and on infinite busbars.

Course Code: ELEN3007A

Course Description: Probabilistic System and Signal Analysis

NQF Credits: 12

NQF Level: 7

(12) (3-1-0) (1 term)

The topics covered in this course are:

- 1) Fundamental concepts of probability.
- 2) Elementary set theory and probability.
- 3) Random variables and probability distributions.
- 4) Some important random variables and their distribution functions.
- 5) Operations on a random variable.
- 6) Vector random variables.
- 7) Random or Stochastic processes.
- 8) Stochastic processes and their spectral characteristics.
- 9) Linear systems with random inputs.

Course Code: ELEN3028A

Course Description: Biomedical Measurement, Instrumentation and Imaging

NQF Credits: 14

NQF Level: 7

(14) (3-0-1) (1 term)

The biomedical measurement; Instrumentation and Imaging course aims to introduce students to the principles and applications of measurement techniques and systems in medical/clinical environments; and to make students aware of the numerous pitfalls in obtaining useful and reliable measurements.

It seeks to provide students with an understanding of measurement error and uncertainty; static and dynamic characteristics of measurement systems; calibration; noise reduction; physical principles of medical instrumentation; and computational; mathematical and hardware aspects of measurement systems including imaging systems.

The course topics include three key areas:

- 1) Understanding metrology in terms of the mathematical; computational; design and hardware aspects of measurement systems including imaging devices
- 2) Medical instrumentation design
- 3) Physics and signal processing/image processing of measuring biosignals including those derived from medical instrumentation and medical imaging systems.

Course Code: ELEN3009A

Course Description: Software Development II

NQF Credits: 18

NQF Level: 7

(18) (3-0-3) (1 term)

This course introduces the student to key aspects of software development. The course covers three main areas: object-oriented modelling and design, programming using modern C++, and key software engineering technical practices. In terms of object-oriented modelling, important concepts such as information hiding, composition, inheritance and polymorphism are explored. Modern C++ covers the use of the auto keyword, range-based for loops, the Standard Template Library, and smart pointers. The software engineering practices that are focused on are unit testing and basic version control.

Course Code: ELEN3012A

Course Description: Signals and Systems II A

NQF Credits: 12

NQF Level: 7

(12) (3-1-0) (1 term)

The Signals and Systems IIA course provides the student with theoretical and mathematical foundations underpinning more specialised courses in Control; Signal processing and Measurements. The course syllabus entails seven key areas:

- 1) Fourier transforms
- 2) Applications of the Fourier transforms
- 3) Bode plots
- 4) Continuous filter design
- 5) State variable modelling
- 6) Solution of the State equations in time and frequency domains
- 7) Sampling continuous time signals.

Course Code: ELEN3013A

Course Description: Signals and Systems II B

NQF Credits: 9

NQF Level: 7

(9) (2-1-0) (1 term)

Signals and Systems course provides the students with theoretical and mathematical foundations underpinning more specialised courses in Control; Signal Processing and Measurements. The emphasis of Signals and Systems IIB is on analysis of discrete time linear systems in the time and frequency domains. The course topics covers four key areas:

- 1) Discrete time signals and LTI systems;
- 2) Discrete Fourier transform and Discrete Time Fourier transform;
- 3) Z-transform;
- 4) Discrete IIR and FIR filters

Course Code: ELEN3014A

Course Description: Biomedical Signals; Systems and Control

NQF Credits: 9

NQF Level: 7

(9) (2-0-0) (1 term)

This course focuses on the following topics:

Discrete time signals; Discrete Fourier transform and the FFT; System Principles; Modelling; Linearisation of non-linear systems; Introductory control concepts; and Application of modelling and control to various biological, physical and economic systems.

Course Code: ELEN3015A

Course Description: Data and Information Management

NQF Credits: 18

NQF Level: 7

(18) (3-1-3) (1 term)

The Objective of this course is to provide the future Information Engineering graduate with tools needed to deal effectively with information in its many forms. The course focuses on information itself:

- 1) Information laws;
- 2) Information conversion and representation;
- 3) Special properties of information which can be exploited for the purposes of storage and transmission;
- 4) Methods of protecting information from natural and human hazard

Course Code: ELEN3016A

Course Description: Control I

NQF Credits: 18

NQF Level: 7

(18) (3-1-2) (1 term)

Control Systems Analysis and Design; which is fundamentally multi-disciplinary in nature; will equip students with the competencies to deal with complex systems that combine subsystems from a wide range of disciplines including electrical; aeronautical; biological; mechanical; chemical; industrial; thermodynamic; economic and medical systems; to name but a few. This course strives to teach students how to analyse such systems as well as to design automatic controllers for such complex systems. The course topics cover four key areas:

- 1) Introduction to control systems
- 2) System modelling and analysis
- 3) Stability analysis
- 4) Time domain and frequency domain control system design

Course Code: ELEN3017A

Course Description: Electrical Engineering Design
--

NQF Credits: 15

NQF Level: 7

(15) (2-0-0) (1 term)

This course is inherently project-based and comprises two in-depth engineering design tasks:

- 1) a paper design project;
- 2) followed by a practical design and development project.

Course Code: ELEN3018A

Course Description: Economics of Design
--

NQF Credits: 12

NQF Level: 7

(12) (2-0-0) (1 term)

This course focuses on principles of macro and micro economics; engineering cost accounting; financial accounts; income statements; balance sheets; ratio analysis; development of business plans; macro-economic analysis.

Course Code: ELEN3024A

Course Description: Communication Fundamentals

NQF Credits: 12

NQF Level: 7

(12) (3-1-0.5) (1 term)

This course focuses on the following topics:

- 1) Communication modes: simplex; half-duplex; full-duplex;
- 2) The A/D and D/A process: PCM; Nyquist criteria; quantization noise;
- 3) Impacts of noise on the communication channel: Shannon-Hartley theorem; types of noise; crosstalk;
- 4) Analog modulation: AM and Angle modulation (FM and PM); modulation and demodulation; bandwidth; noise performance;
- 5) Digital modulation: PSK; QPSK; M-FSK; M-QAM; OFDM; modulation and demodulation; bandwidth; noise performance (BER; SNR); information rate (bits/symbol); constellations; eye patterns;
- 6) Multi-user techniques: TDM; FDM;

Course Code: ELEN4000A

Course Description: Electrical Engineering Design II

NQF Credits: 24

NQF Level: 8

(24) (6 weeks; full-time)

This course consists of an extended design project; on which a comprehensive report is to be submitted by each candidate. This report will be assessed on the merits of the work reported and its suitability as a technical communication.

Course Code: ELEN4001A

Course Description: High Frequency Techniques
--

NQF Credits: 15

NQF Level: 8

(15) (2-1-1) (1 term)

This course focuses on the following topics:

- 1) revision of antenna fundamentals: electromagnetic spectrum; radiation basics; polarization; directivity and gain; reciprocity; aperture; radiation resistance; link equation (FRIS); field and power flow; modulation schemes and noise.
- 2) thin linear antennas: fields from potentials; fields from current carrying wires; the ideal dipole; short dipole; short monopole; reactance of small antennas; sinusoidal dipole; ohmic losses; matching; baluns; thickness factor.
- 3) array theory: isotropic arrays; pattern multiplication; binomial arrays; uniform arrays; interferometer; multi-beam "smart antennas"; continuous aperture distributions.
- 4) common antenna types: travelling wave (HF) antennas; small loop; and slot antennas; normal mode helical; axial mode helical; reflector antennas; including the corner reflector; yagi-uda; log periodic dipole array (LPDA).

Course Code: ELEN4002A

Course Description: Electrical Engineering Laboratory
--

NQF Credits: 33

NQF Level: 8

(33) (8 weeks; full-time)

The course requires students to undertake a significant engineering study under limited supervision; involving aspects such as background research; planning; implementation; testing; critical analysis and the communication of the findings and results of the study.

Course Code: ELEN4003A

Course Description: High Voltage Engineering

NQF Credits: 15

NQF Level: 8

(15) (2-1-1) (1 term)

The High Voltage Engineering (HV) course provides knowledge on the application of fundamental sciences in the analysis and control of electric fields in high voltage equipment. The knowledge areas are:

- 1) Conduction and breakdown processes in gases; liquids and solids.
- 2) Insulation assessment and design considerations for HV equipment.
- 3) Generation and measurement techniques of high testing voltages and currents (DC; AC; Impulse).

Course Code: ELEN4006A

Course Description: Measurement Systems
--

NQF Credits: 15

NQF Level: 8

(15) (2-1-1) (1 term)

This course is designed to form a bridge between the subjects of the previous three years and the design and laboratory projects. Sensors and condition elements are covered and the main emphasis is on analysis, visualization and modelling of measurement systems. The course consists of Instrumentation systems concepts and terminology static and dynamic properties of measurement systems and calibration. Introduction to statistical techniques for handling measurement uncertainty and noise.

Course Code: ELEN4009A**Course Description: Software Development III****NQF Credits: 15****NQF Level: 8****15) (2-1-1) (1 term)**

This course provides students with a broad introduction to the software development lifecycle and explores how an engineering approach can be applied to each phase of this lifecycle. The course syllabus covers the following key areas:

- 1) The software development lifecycle and its various models
- 2) Requirements engineering
- 3) Software architecture; analysis and design
- 4) Software development
- 5) Testing and validation
- 6) Agile software development

Course Code: ELEN4010A**Course Description: Software Engineering****NQF Credits: 5****NQF Level: 8****(15) (2-1-1) (1 term)**

This course focuses on “modern” software development. Modern software development is defined as being highly collaborative, making use of an agile methodologies, and using modern platforms, languages, technologies, and architectures. In terms of collaboration, students will learn how to work effectively in small teams and use tools like version control to continuously integrate and deliver software solutions. Agile project management approaches will be explored and practiced illustrating how agile teams can be responsive to change and maximise value for the customer. The web as a development platform, browser technologies, and a client-server architecture will be introduced.

Course Code: ELEN4011A**Course Description: Information Engineering Design****NQF Credits: 5****NQF Level: 8****(24) (6 weeks; full time)**

This course consists of an extended design project appropriate to Information Engineering students. A comprehensive report is to be submitted by each candidate. This report will be assessed on the merits of the work reported and its suitability as a technical communication.

Course Code: ELEN4012A**Course Description: Information Engineering Laboratory****NQF Credits: 33****NQF Level: 8****(33) (8 weeks; full-time)**

The course requires students to undertake a significant engineering study under limited supervision; involving aspects such as background research; planning; implementation; testing; critical analysis and the communication of the findings and results of the study.

Course Code: ELEN4014A**Course Description: Electromechanical Conversion****NQF Credits: 15****NQF Level: 8**

(15) (2-1-1) (1 term)

This course focuses on the following topics:

Review of Electromagnetic Fundamentals; AC and DC Machines; Mechanical Loads; Development of the d-q Model; Principles of Vector Control; Unconventional Motors; Computer Analysis and Simulation of Electrical Drives.

Course Code: ELEN4016A

Course Description: Control II

NQF Credits: 15

NQF Level: 8

(15) (2-1-1) (1 term)

This course focuses on the following topics:

Robust control and performance analysis for Multi-input Multi-output (MIMO) systems:

Digital control; Design; simulation and implementation of digital controllers; Advanced control techniques and identification: A selection of control strategies such as; but not limited to; genetic algorithms for control; Neuro-Fuzzy control; Optimal control and optimisation techniques; Nonlinear control techniques; Real-time controllers and systems. These control strategies are used as tools for system modelling; analysis and control of classes of nonlinear and multi-variable systems.

Course Code: ELEN4017A

Course Description: Network Fundamentals

NQF Credits: 15

NQF Level: 8

(15) (2-1-1) (1 term)

This course provides students with the fundamental concepts in the area of computer/communication networking. The emphasis of the course will be on the principles behind the working of networks and not on the actual protocols. This will enable the students to apply these concepts to different types of communication networks. The course will take 'Internet' as the example network for discussion of different concepts. The course topics include:

- 1) Introduction to networking
- 2) Algorithms/protocols at Application Layer
- 3) Algorithms/protocols at Transport Layer
- 4) Algorithms/protocols at Network Layer
- 5) Algorithms/protocols at Data link Layer

Course Code: ELEN4018A

Course Description: Power Systems

NQF Credits: 15

NQF Level: 8

(15) (2-1-1) (1 term)

This course covers the following topics:

- 1) Power transmission: Constants of transmission lines; design of overhead lines and cables; voltage and current relations and performance of transmission links under steady state and transient conditions; power system stability.
- 2) Protection: Current and voltage transformers; symmetrical components; fault calculations; characteristics of protective relays; protection of transformers; generators; motors and transmission lines.

Course Code: ELEN4019A

Course Description: Selected Topics in Sociology

NQF Credits: 12

NQF Level: 8

(12) (2-1-0) (1 term)

This course introduces students to contemporary perspectives on South African society. Its aim is to help students build a critical understanding of social analysis through the discipline of sociology.

Students are assisted with:

- 1) insight into our social; political and economic environment through multidisciplinary approaches while being firmly anchored within the discipline of sociology;
- 2) a critical understanding of society from a global and South African/African perspective; and
- 3) Practicing and acquiring methods of critical thinking and writing.

Course Code: ELEN4020A

Course Description: Data Intensive Computing in Data Science

NQF Credits: 15

NQF Level: 8

(15) (2-1-2)

This course focuses on the following:

- 1) Parallel computing platforms and programming models
- 2) Shared-memory and concurrent programming with Pthreads/Cilkplusplus/OpenMP
- 3) Introduction to Message Passing Interface (MPI)
- 4) Large-scale data management techniques in distributed parallel computing
- 5) In-memory data management techniques - BerkeleyDB; LevelDB
- 6) Parallel File Systems and Parallel Database - BeeGFS; SciDB
- 7) MapReduce computing framework: Hadoop in cluster computing & Hadoop in cloud computing
- 8) Data intensive computing applications over HDF5 and parallel-HDF5

Topics can be selected from the list below:

- a) Big-data warehousing and business intelligence
- b) Spatial and Spatio-Temporal applications
- c) Health demographic and surveillance systems
- d) Meta-data services; data discovery and data provenance

Course Code: ELEN4022A

Course Description: Full Stack Quantum Computing

NQF Credits: 15

NQF Level: 9

This course focuses on the application of fundamental sciences in quantum computing. Topics include fundamentals of quantum mechanics, basic principles of quantum hardware, basics of quantum information processing and applied quantum computing.

Course Code: ELEN4023A

Course Description: Renewable Energy

NQF Credits: 15

NQF Level: 8

This course on renewable energy covers the application of various aspects of renewable energy sources, generation and application. Topics include; fundamentals of renewable energy sources, PV generation, wind generation, hydroelectric generation, other renewable energy sources -marine, thermo-electric, etc, energy storage and smart grids, and applications including electric vehicles.

Course Code: ELEN5000A

Course Description: Measurement Systems

NQF Credits: 20

NQF Level: 8

This course focuses on the following topics:

Revision of applicable material from electronics; probabilistic signals and systems.

Instrumentation systems concepts and terminology. Static and dynamic properties of measurement systems; calibration. Introduction to statistical techniques for handling measurement uncertainty. Noise. Transducers based on varying R; L; C. Signal conditioning. Thermocouples; piezoelectric transducers.

Course Code: ELEN5001A

Course Description: High Frequency Techniques

NQF Credits: 20

NQF Level: 8

This course focuses on the following topics:

- 1) Revision of Electromagnetic Engineering fundamentals and principles- Maxwell's equations and applicable mathematical techniques.
- 2) Revision of Antenna Fundamentals: Electromagnetic Spectrum; Radiation Basics;
- 3) Polarisation; Directivity and Gain; Reciprocity; Aperture; Radiation Resistance; Link Equation (Friis); Field and Power Flow; Modulation Schemes and Noise.
- 4) Thin Linear Antennas: Fields from Potentials; Fields from current carrying wires; The ideal dipole; Short Dipole; Short Monopole; Reactance of small antennas; Sinusoidal Dipole; Ohmic Losses; Matching; Baluns; Thickness Factor.
- 5) Array Theory: Isotropic arrays; Pattern Multiplication; Binomial Arrays; Uniform Arrays; Interferometer; Multi-beam "Smart Antennas"; Continuous Aperture distributions.
- 6) Common Antenna Types: Travelling wave (HF) antennas; Small loop; and slot antennas; Normal mode helical; Axial mode helical; Reflector antennas; including the Corner Reflector; Yagi-Uda; Log Periodic Dipole Array (LPDA).

Course Code: ELEN5002A

Course Description: High Voltage Engineering

NQF Credits: 20

NQF Level: 8

This course focuses on the following topics:

Revision of Electromagnetic Engineering fundamentals and principles; as well as applicable principles of power engineering Conduction and breakdown processes in gases; liquids and solids. Generation of HV testing voltages (and high testing currents); HV measurement technique. Insulation assessment and design considerations for HV equipment.

Course Code: ELEN5005A

Course Description: Electromechanical Conversion

NQF Credits: 20

NQF Level: 8

This course focuses on the following topics:

Revision of Electromagnetic Engineering fundamentals and principles; as well as applicable principles of power engineering AC and DC Machines; Mechanical Loads; Development of the d-q Model; Principles of Vector Control; Unconventional Motors; Computer Analysis and Simulation of Electrical Drives.

Course Code: ELEN5006A

Course Description: Network Fundamentals

NQF Credits: 20

NQF Level: 8

This course focuses on the following topics:

Revision of basic communication fundamentals; The ISO reference model will be used to discuss each of the layers and the functionality it provides. Application layer discussions will focus on standardised protocols that support many application types. Transport layer discussions will focus on achieving reliable transfer over an unreliable channel; flow and congestion control. Network layer discussions will cover global hierarchical addressing and the operation of routing. The data link layer will cover local area networks and their operation.

Course Code: ELEN5007A**Course Description: Control II****NQF Credits: 20****NQF Level: 8**

This course focuses on the following topics:

Revision of basic control theory and signals and systems

Robust control and performance analysis for Multi-input Multi-output (MIMO) systems: Digital control; Design; simulation and implementation of digital controllers; Advanced control techniques and identification: A selection of control strategies such as; but not limited to; genetic algorithms for control; Neuro-Fuzzy control; Optimal control and optimisation techniques; Nonlinear control techniques; Real-time controllers and systems. These control strategies are used as tools for system modelling; analysis and control of classes of nonlinear and multi-variable systems.

Course Code: ELEN5008A**Course Description: Power systems****NQF Credits: 20****NQF Level: 8**

This course focuses on the following topics:

Revision of applicable concepts from Electromagnetic Engineering and Power Engineering Power transmission: Constants of transmission lines; design of overhead lines and cables; voltage and current relations and performance of transmission links under steady state and transient conditions; power system stability.

Protection: Current and voltage transformers; symmetrical components; fault calculations; characteristics of protective relays; protection of transformers; generators; motors and transmission lines.

Course Code: ELEN5009A**Course Description: Database Systems****NQF Credits: 20****NQF Level: 8**

The course covers the principles underlying information modelling and database design and implementation. In particular, the course covers geospatial information as an important engineering application; and knowledge management as an important information management application. The content of the course covers: database theory: relational databases; normalisation; SQL; object-oriented databases; data locking and transaction processing; database design; spatial databases: location-based applications; Geographical Information Systems (GIS) and information and knowledge management applications.

Course Code: ELEN5010A**Course Description: Introduction to Software Engineering****NQF Credits: 20****NQF Level: 8**

This course is a historical overview of software engineering, from the earliest years to the present. The course focuses on the behaviour of a team under the influence of governance, Agile or Plan-driven. A selection of practices of software engineering: from the perspective of plan-driven; controlled quality approaches as well as from an agile; crafted quality point of view. Software Engineering standards; methods and theory. Synergies between Software Engineering and Systems Engineering. The Information Systems Engineering Framework.

Course Code: ELEN5011A**Course Description: Selected Topics in Software Engineering****NQF Credits: 20****NQF Level: 8**

The topic varies from year to year.

Course Code: ELEN5012A**Course Description: Software Development Methodologies; Analysis and Design****NQF Credits: 20****NQF Level: 8**

This course has two major components. The first involves the task of software design within the context of the wider development process. The second introduces the student to a variety of software development methodologies. A number of examples and case studies are presented and students gain experience in developing designs of their own and in groups. Important topics such as problem frames and analysis and design patterns are covered.

Course Code: ELEN5013A**Course Description: Software Project Management****NQF Credits: 20****NQF Level: 8**

The course introduces key issues in the field of Software Project Management. Topics covered include: introduction to software project management; the life cycle revisited; project planning and control; monitoring and control; cost estimation; software quality; people and teams; contract management; global software development.

Course Code: ELEN5014A**Course Description: Software Technologies and Techniques****NQF Credits: 20****NQF Level: 8**

This course extends on basic material and concepts introduced at undergraduate level and develop a richer insight into the rapidly changing technical area of software development. Students are required to deliver a presentation that focuses on software development issues relevant to the course content. A major component of this course involves effective teamwork where students work in groups on a substantial software development project.

Topics covered include: Software development languages; paradigms and philosophies; pragmatic programming; team working and software project management; operating systems and system architectures; client-server/multi-tier applications and architectures; distributed application standards; distributed and parallel processing; information models and systems; databases and data modelling; software in business and e-business.

Course Code: ELEN5017A**Course Description: Distribution System Engineering****NQF Credits: 20****NQF Level: 8**

This course introduces key concepts in the planning, design and operation of utility distribution systems, key concepts of load modelling, load forecasting, the design of distribution substations and distribution feeders and the associated protection and automation schemes. It also discusses the design of tariff structures and the future of distribution systems with the widespread implementation of smart grid technologies and embedded generation.

Course Code: ELEN5016A**Course Description: Electric and Hybrid Vehicles****NQF Credits: 20****NQF Level: 8**

This course introduces automotive technology and specific concepts in pure electric and hybrid electric vehicles. It explores the factors affecting vehicle performance, Electric Vehicle (EV) and Hybrid Electric Vehicle (HEV) propulsion systems, types, benefits and disadvantages of electric motors for electric propulsion system and battery management strategies.

Course Code: ELEN5015A**Course Description: Transmission System Engineering****NQF Credits: 20****NQF Level: 8**

This course introduces the student to key concepts in the optimisation and design of utility transmission systems. The design of transmission substations together with the associated protection and automation schemes is covered in detail. HVDC technologies (including control) as an alternative to HVAC technologies are studied. The future of open-access transmission systems together with associated electricity markets is explored.

Course Code: ELEN5035A

Course Description: Renewable Energy

NQF Credits: 20

NQF Level: 8

This course introduces contemporary renewable energy technologies, including sustainability and environmental issues, energy resources, electric power generation from renewable energy sources, such as solar, wind, geothermal, wave, tide, hydro and fuel cells. This course provides an understanding of energy storage and system integration and includes developments in electrical utilisation in electric and hybrid vehicles. The course covers design techniques for renewable energy systems and design skills in renewable energy systems. The course provides knowledge on the application of various aspects of renewable energy sources, generation and application. Topics covered include; fundamentals of renewable energy sources, PV generation, wind generation, hydroelectric generation, other renewable energy sources - marine, thermo-electric, etc, energy storage and smart grids, renewable energy business cases, and applications including electric vehicles.

Course Code: ELEN7007A

Course Description: Electrical Discharges in Gases

NQF Credits: 20

NQF Level: 9

This course is concerned with the physical processes that change a gas from being a good insulator to being a good conductor. All the stages in this process are considered from the initial ionisation; to corona and to breakdown. The lectures deal with the mechanisms of electron production and multiplication; the fundamental properties of the resultant discharge and the decay of the plasma following the removal of the electric field. Examples are given as seen mainly from the viewpoint of the electricity supply industry. The behaviour of gas-solid interfaces is also examined in a similar fashion.

Course Code: ELEN7009A

Course Description: Principles of Insulation Coordination in Electrical Power Systems

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics:

Introduction; lightning parameters; lightning performance of transmission lines; switching performance of transmission lines; AC performance of transmission lines; modelling breakdown behaviour; insulation co-ordination of substations and distribution networks.

Course Code: ELEN7010A

Course Description: Selected Topics

NQF Credits: 20

NQF Level: 9

There is no syllabus for this course – the topic varies from year to year.

Course Code: ELEN7012A

Course Description: Selected Topics in Software Engineering

NQF Credits: 20

NQF Level: 9

There is no syllabus for this course – the topic varies from year to year.

Course Code: ELEN7013A

Course Description: Selected Topics in Power Engineering

NQF Credits: 20

NQF Level: 9

There is no syllabus for this course – the topic varies from year to year.

Course Code: ELEN7015A**Course Description: Teletraffic Engineering****NQF Credits: 20****NQF Level: 9**

This course focuses on: Teletraffic engineering; based on teletraffic theory; provides the means to analyse; design and monitor networks to ensure that the networks carry end user and signaling information to the satisfaction of end users.

The course topics include:

- 1) Apply key concepts in probability to describe teletraffic;
- 2) Perform key calculations in switched circuit networks;
- 3) Apply the principle concepts of queueing theory to traffic modelling;
- 4) Formulate models for teletraffic problem situations.

Course Code: ELEN7016A**Course Description: Intelligent Networks****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

History; drivers and enablers of the Intelligent network (IN); basic principles of IN; the IN Conceptual Model and its planes; IN-based services; IN Standards; Telecommunications Management Network; future evolution of the IN.

Course Code: ELEN7018A**Course Description: Earthing and Lightning Protection****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

Lightning physics and the point of strike. Theory and practice of external lightning protection. Theory and practice of internal lightning protection. Earth electrode systems and characteristics. Philosophy of site-wide earthing. Evaluation of direct and indirect strikes. Project planning for existing and new systems. SPD's – choice and characteristics; installation practice.

Course Code: ELEN7020A**Course Description: Non-Linear Modelling; Estimation and Control****NQF Credits: 20****NQF Level: 9**

This course focuses on non-linear modelling; estimation and control and provides students with the mathematical foundations and theory for analysing nonlinear systems. The course topics include:

- 1) Popov and circle criteria
- 2) Phase plane methods
- 3) Lyapunov methods
- 4) Flows and vector fields on a manifold
- 5) Chaotic dynamics
- 6) Bifurcation theory
- 7) Catastrophe theory

Course Code: ELEN7021A**Course Description: Optimisation Methods****NQF Credits: 20****NQF Level: 9**

The Optimisation Methods course provides the candidate with an introduction to the mathematics and both the analytical and numerical techniques of linear and nonlinear optimisation which can be applied in many areas of Engineering. The course syllabus entails seven key areas:

- 1) Optimisation performance criteria
- 2) Optimisation problem formulation
- 3) Lagrange multipliers
- 4) Calculus of variations
- 5) Linear programming
- 6) Non-linear programming
- 7) Dynamic programming.

Course Code: ELEN7022A

Course Description: Artificial Intelligence Methods

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics:

The logical foundations of artificial intelligence; rules of inference; knowledge representation and manipulation. Expert systems; fuzzy logic and the fuzzy logic controller; neural networks; genetic algorithms; distributed and multi-agent systems.

Course Code: ELEN7024A

Course Description: Modelling and System Identification

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics:

Model types; relationship between modelling and simulation; physical modelling; bond graphs. Model identification methods; discrete-time; continuous-time and frequency-domain methods. Data selection and experiment design. Recursive identification. Non-linear models.

Course Code: ELEN7027A

Course Description: Embedded Computer Systems

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics:

Digital signal processor (DSP) architectures; special features and development tools. Translating signal processing requirements to code specifications. Real-time assembly level coding; debugging and testing. Selected Embedded System design topics.

Course Code: ELEN7032A

Course Description: Advanced Telecommunications Service Architectures

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics:

Drivers of telecommunications services. The TINA architecture: rationale for TINA; definition of TINA; business case approach of TINA; TINA standardisation; the TINA consortium; relationships with other standards initiatives and the OMG in particular. TINA Computing Architecture; Role of CORBA; TINA Service Architecture; TINA Network Resource; TINA Management Architecture; TINA applications.

Course Code: ELEN7033A

Course Description: Research Methods

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics:

Research problem formulation; compiling; organising and critically reviewing literature; dividing problems into sub problems; identifying required data; variables and controls; drawing up a research proposal. The main outcome of the course is the preparation of a research proposal on a research topic of the student's choice; suitable for submission.

Course Code: ELEN7043A**Course Description: Advanced Electromechanical Conversion****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

Introduction to electromechanical concepts; including state-space modelling of the systems. Investigating various popular structures; e.g. asynchronous machines. Also introducing the concepts of linear motors as well as other mechanical force or torque producing structures. Aspects of the electronic control of such devices.

Course Code: ELEN7044A**Course Description: Introduction to Software Engineering****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

The field of Software Engineering (SE) aims to bring a systematic and disciplined approach to the task of developing and maintaining software. This course provides students with a broad introduction to the software development lifecycle and explores how an engineering approach can be applied to each phase of this lifecycle. An important aspect of the course is that it highlights some of the debates and controversies surrounding modern SE practice. The course topics include:

- 1) The software development lifecycle and its various models
- 2) Requirements engineering
- 3) Software architecture; analysis and design
- 4) Software development
- 5) Testing and validation
- 6) Agile software development

Course Code: ELEN7045A**Course Description: Software Development Methodologies; Analysis and Design****NQF Credits: 20****NQF Level: 9**

Candidates attending this course will develop an understanding of the role of software design as the important link between requirements and the delivery of a functional solution. Candidates will be introduced to a variety of software development methodologies and how each of these impacts the manner in which design is carried out. Material is presented via examples and case studies. Candidates are also given an opportunity to develop a number of designs working alone and in groups. The course topics include:

- 1) Problem frames
- 2) Analysis and Design Patterns
- 3) Domain Driven Design

Course Code: ELEN7046A**Course Description: Software Technologies and Techniques****NQF Credits: 20****NQF Level: 9**

This course builds on foundational material found at an undergraduate level by presenting candidates with richer insights into the rapidly changing landscape of modern software development. A major component of this course is to develop a practical appreciation of effective teamwork. Candidates are required to work in groups on a substantial software development project. Since technical communication is another critical skill; students are also required to deliver a presentation on relevant software development issues. Key topics include:

- 1) Software development languages; paradigms and philosophies
- 2) Pragmatic programming

- 3) Operating systems and system architectures
- 4) Distributed application standards
- 5) Distributed and parallel processing
- 6) Information models; databases and data modeling
- 7) Modern application areas.

Course Code: ELEN7047A

Course Description: Software Project Management

NQF Credits: 20

NQF Level: 9

The course introduces candidates to key issues in the field of software project management. Managing the delivery of a medium to large software project often entails achieving a critical balance between contradictory objectives such as time; budget; quality and scope. The course presents methodologies that aim to achieve the necessary trade-offs between these objectives. Key topics of this course include:

- 1) Introduction to software engineering concepts and problems;
- 2) Introduction to Software Project Management (SPM): problems and objectives;
- 3) Survey of important management approaches; planning; costing.
- 4) People management and team working
- 5) Quality management systems and quality standards

Course Code: ELEN7048A

Course Description: Variable Speed Drives for AC Machines

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics:

Concepts of mechanics; space vector theory of AC motors; control of AC motors; scalar and vector; AC-AC converters – cycloconverters; DC-AC converters; slip energy recovery.

Course Code: ELEN7049A

Course Description: Telecommunications Access Networks

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics:

- 1) Evolution of the Access Network: Architectures for copper; powerline; fibre and wireless access networks. Medium characteristics for link budget planning. Narrow and Broadband Access Networks. SDH and the Access Network Transport. Design considerations of Access Networks to include coverage and capacity requirements. Topological design of Access Networks.
- 2) Fixed and Mobile Access Networks: Architecture of the Public Land Mobile Network (PLMN). Radio channel characterisation; pass loss and multipath modelling and their impact on coverage and capacity design of PLMN; designing for mobile radio fast fading channels; QoS issues in Mobile radio; GSM Air-Interface; CDMA Air-Interface; Wireless Data provisions in Mobile Radio Networks; Evolution from 2G to 3G. Operational considerations of PLMNs (e.g. geospatial-aided network inventory management and network planning) and examples of Mobile Computing and other wireless data applications.

Course Code: ELEN7051A

Course Description: Linear Modelling; Estimation and Advanced Linear Control

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics:

State-space and input-output models in continuous time and discrete time; observers; single-input single out-put and multi-input multi-output controllers; stochastic models; the Kalman filter; advanced linear control. Adaptive control.

Course Code: ELEN7052A

Course Description: Selected Topic – Systems and Control

NQF Credits: 20

NQF Level: 9

There is no syllabus for this course – the topic varies from year to year.

Course Code: ELEN7055A

Course Description: Database Systems

NQF Credits: 20

NQF Level: 9

Large information models are an important component in many modern engineering applications. The course covers the principles underlying information modelling and database design and implementation. The application of these principles to important engineering tasks is then presented. In particular the course covers; geospatial information as an important engineering application; and Knowledge Management as an important information management application. Content: Database theory: relational databases; normalisation; SQL; object-oriented databases; data locking and transaction processing. Database design. Spatial databases: location-based applications; Geographical information Systems (GIS); Information and Knowledge Management applications.

Course Code: ELEN7056A

Course Description: Power Electronics

NQF Credits: 20

NQF Level: 9

This course introduces candidates to the application of the two most important semiconductor devices for the control of power – the silicon controlled rectifier (SCR) and the insulated gate bipolar transistor (IGBT). The course then proceeds to examine the circuits; and analyse the performance of the various types of variable speed drives for both AC motors (synchronous and induction) and DC motors. The problems associated with variable speed drives; such as the injection of current harmonics back into the supply are also examined. Characteristics; ratings and protection of SCR's; GTO's; BJT's; MOSFET's and IGBT's. AC-DC converters. Harmonics in power systems. DC-DC converters. DC- AC inverters. AC- AC converters.

Course Code: ELEN7057A

Course Description: Advanced Power Systems Analysis

NQF Credits: 20

NQF Level: 9

The course starts off by examining the steady state behaviour of power system components. The course then covers the transient characteristics of synchronous generators. The behaviour of a synchronous generator following small disturbances and large disturbances (large signal or transient stability) is examined. The course ends up by examining the stability; voltage control and frequency control issues with power systems.

Course Code: ELEN7059A

Course Description: Principles of Communication Systems

NQF Credits: 20

NQF Level: 9

This course covers the basics of digital and analogue information transfer over wired and wireless links. Topics include baseband and band-pass (M-FSK; M-PSK; M-QAM) modulation formats and associated pulse shaping; symbol timing and carrier recovery techniques; together with band-pass analogue modulation techniques. The course covers mobile radio propagation; modulation theory; diversity combining; cellular radio architectures and capacity calculation. The aim is to provide an insight into the choice of access techniques in future generation wireless networks. Analytical tools for describing information transfer and uncertainty are discussed and applied to practical data and communication systems. The key parameters that govern power and bandwidth of a communication system are introduced. The course examines both analogue and digital modulation schemes and coherent and non-coherent detection techniques.

Course Code: ELEN7060A**Course Description: Introduction to Packet Networks****NQF Credits: 20****NQF Level: 9**

This course introduces fundamental principles in modern data communications by providing detailed coverage of packet network principles and architecture. The Open Systems Interconnection model is used as basis to discuss key concepts of abstraction and decoupling. The TCP/IP protocol stack; as used in the modern Internet; is used as an example to illustrate a concrete implementation of packet network principles. Using this approach students are exposed to the application; transport; network and data-link layers. Coverage of the application layer discusses standardised protocols that enable modern services such as web browsing; email; multimedia streaming; etc. Transport layer concepts focus on reliable data transfer over unreliable channels; multiplexing of applications on a host; flow and congestion control. Network layer concepts focus on hierarchical global addressing schemes; and autonomous routing techniques. Data-link layer concepts provide coverage of addressing and routing within a local area network (LAN).

Course Code: ELEN7061A**Course Description: Telecommunications Business Environment****NQF Credits: 20****NQF Level: 9**

This course focuses on strategic management issues related to running a telecommunications operating company [Telco]; enabling course participants to appreciate the business perspectives of telecommunications both in South Africa and globally. Emphasis is on providing an understanding of the interactive nature of the forces impacting on the performance of Telcos.

Course Code: ELEN7062A**Course Description: Coding Techniques for Telecommunications****NQF Credits: 20****NQF Level: 9**

This course covers the basics of error control coding techniques; which are widely used in digital and analogue information transfer over wired and wireless communications. Topics include mutual information; Shannon limit; Hamming distance; Hamming codes; linear algebra codes; cyclic redundancy check; Reed-Solomon codes; Berlekamp-Massey decoding; soft-decision decoding; erasure decoding; low-density parity-check codes; belief propagation decoding; convolutional codes; Viterbi decoding; concatenated coding system. Coding techniques presented in this course have been utilised by all types of telecommunication systems. The aim is to provide an insight into the existing techniques in the current and the future generation telecommunication systems. Analytical tools for describing information transmission capacity and uncertainty are discussed and applied to practical communication systems.

Course Code: ELEN7063A**Course Description: Network Planning; Performance and Services Management****NQF Credits: 20****NQF Level: 9**

The course gives an understanding of the processes of designing and planning telecommunications; broadband and IP-based networks. The process is taken from the creation of market forecasts of demand on the network; to the implementation of plans. Aspects of the design that influence the likely replacement of the PSTN; the ATM and IP networks are also covered. It also deals with the performance that a network must be designed to meet and those performance parameters that impact on the quality of service perceived by customers. This module also presents a layered view of network and service management requirements and operations. It begins with a review of network management; identifies key functional areas and details support systems and associated architectures.

Course Code: ELEN7064A**Course Description: Principles of Wireless Communications****NQF Credits: 20****NQF Level: 9**

The main focus of this course is on the design; analysis and fundamental limits of wireless transmission systems in the context of the Long Term Evolution (LTE) Wireless Communication Systems. The course will provide the student with ability to apply a systems approach to engineering problems; investigate new and emerging technologies; analyse key trade-offs in the design of communication systems; and present a coherent report on a topic that is initially unfamiliar. The course topics include:

- 1) Background of Long Term Evolution (LTE)
- 2) Objectives of LTE
- 3) Physical Layer of LTE:
- 4) Layer 2
- 5) Core network
- 6) Voice over LTE
- 7) LTE and WiMAX
- 8) Heterogeneous Networks

Course Code: ELEN7065A

Course Description: Telecoms Network Architectures

NQF Credits: 20

NQF Level: 9

This course introduces fundamental principles in the design and operation of modern telecommunication networks; with specific focus on the core network. Topics included are control signaling (ISUP); principles of mobile wireless networks (mobility management/ roaming /handover) using GSM as a case study; peripheral and value-added services using Intelligent Networks as a case study. The aim is to provide the student with a clear understanding of the overall architecture of a telecommunications network and thus enable the student to deal with the complexity of evolving technologies such as 3G and 4G.

Course Code: ELEN7066A

Course Description: Global Trends and Sustainability of Energy Generation

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics:

- 1) Global overview of power generation and the history of power generation
- 2) Alternate sources of power generation
- 3) Regional competitive advantage of specific methods of power generation
- 4) Models for sustainable power generation using alternate sources
- 5) Develop an understanding of the various power generation options being pursued in specific regions for various applications and understand the reasons for the adoption of these options

Course Code: ELEN7067A

Course Description: Research Methodology

NQF Credits: 15

NQF Level: 9

Research is considered to be the process of making new knowledge. In this course, this process will be approached from the following points of view:

- 1) Determining what constitutes knowledge in different domains.
- 2) Determining a good research question.
- 3) Determining when new knowledge is a contribution to existing knowledge.
- 4) Determining what foundation is required for new knowledge.
- 5) The research tools of creative problem solving; argument and planning will be developed

Course Code: ELEN7068A

Course Description: Research/Industrial Project

NQF Credits: 45

NQF Level: 9

In this course candidates are required to investigate a problem or topic in the general field of engineering which must include: a detailed literature review; data collection, analysis and interpretation; conclusions and commensurate recommendations on the solution to the problem or topic. A comprehensive report demonstrating the candidates' competencies in the investigation, its evaluation and technical reporting must be submitted.

Course Code: ELEN7069A**Course Description: Applied Quantum Computing****NQF Credits: 20****NQF Level: 9**

This course focuses on the application of quantum computing principles. The emphasis is on project-based learning through engagement with relevant industrial and research projects. Topics include quantum mechanics, quantum hardware, quantum information processing and application of quantum computing.

SCHOOL OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

Course Code: GEOG1003A**Course Description: Geography for Planners****NQF Credits: 24****NQF Level: 5**

The course will cover geomorphology; the geology and archaeology of Greater Johannesburg; rural development; Southern African climate. Related practical techniques will also be covered; in addition to map reading and basic research techniques. Practicals will apply to the material covered in the theoretical aspects of the course; and in specific cases these will be linked to studio work being undertaken in the BSc Urban and Regional first year programme.

SCHOOL OF GEOSCIENCES

Course Code: GEOL1006A**Course Description: Geology IA****NQF Credits: 16****NQF Level: 5****(16) (4-0-2)**

The course introduces mining engineering students to various aspects of a multi-disciplinary science that integrates the principles of chemistry, physics, biology and mathematics in the study of Earth processes and history. The course presents the following broad topics: mineralogy, internal processes and surface processes. The course integrates theory and practical, which enables students to identify common minerals and rocks; and also interpret geological maps.

Course Code: GEOL1007A**Course Description: Geology IB****NQF Credits: 16****NQF Level: 5****(16) (4-0-2) (1 term)**

The course extends the concepts introduced in Geology 1A and develops an understanding of formation and classification of ore deposits. The course presents the following broad topics: structural geology, economic geology and African geology. The course augments map interpretation skills introduced in Geology 1A and further enables students to solve geological structural problems in a mining context.

Course Code: GEOL2027A**Course Description: Geology for Civil Engineers****NQF Credits: 16****NQF Level: 7**

This course provides students with the competencies to understand geological processes and the formations that arise from such processes and includes the following topics:

- 1) Minerals: rock-forming minerals, internal structure, physical properties, mineral groups
- 2) Rocks: Igneous, metamorphic and sedimentary rocks

- 3) Geological processes: folding, faulting, igneous intrusions
- 4) Structural geology: interpretation of geological maps and sections
- 5) Geomorphology: weathering, transportation and deposition processes
- 6) Geohazards and residual soils: formation of residual soils, problem soils, Southern African terrain descriptions
- 7) Stratigraphy: South African stratigraphy, special attention to Gauteng area
- 8) The hydrological cycle, surface water and ground water. Surface water processes
- 9) Practical classes are fully integrated with the lecture component of the course

Course Code: GEOL3051A

Course Description: Ore Body Modelling

NQF Credits: 16

NQF Level: 7

(16) (4-0-2) (1 term)

The course presents practical and theoretical aspects of methods of exploring for and evaluating ore deposits, ore body modelling and its role in mineral deposit evaluation and exploitation. The course acquaints students with fundamental applied processes and inherent biases and weaknesses in modelling of ore resources in their different geological and geophysical settings, leading to higher levels that use computer-based modelling techniques. Practical work complements theory and includes orebody modelling based on surface borehole, as well as underground sampling and geological data.

SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT

Course Code: PSYC2019A

Course Description: Human Resources Psychology II

NQF Credits: 12

NQF Level: 6

(12) (2-1-0) (1 term)

This course focuses on the application of psychology in the areas of personnel and industrial relations. Personnel psychology deals with the organisational objective of producing goods or services efficiently; including: strategic planning; fairness and ethical considerations; personnel recruitment; selection; development and motivation. Industrial relations focus on the social and psychological processes involved in employee relations from the sociological; political; economic; legal and historical perspectives.

SCHOOL OF LAW

Course Code: LAWS1000A

Course Description: Commercial Law I

NQF Credits: 18

NQF Level: 5

This course covers the following topics:

- 1) Introduction to the study of law; being an elementary study of the basic legal concepts; the principles of criminal and delictual liability in broad outline; basic procedural law; the South African legal system; including a reference to the structure of the courts; sources of law and officers of the courts; a description of the main divisions of the law; contractual capacity.
- 2) General principles of the law of contract; an examination of the features of important specific contracts; including sale; lease and agency.

Course Code: LAWS2007A

Course Description: Business Enterprise Law

NQF Credits: 24

NQF Level: 6

General principles of the formation; administration and winding-up of the different forms of business enterprise including a study of the company; the close corporation and the partnership.

SCHOOL OF LITERATURE, LANGUAGE AND MEDIA**Course Code: AFRL1003A****Course Description: Elementary IsiZulu Language and Culture IA****NQF Credits: 24****NQF Level: 5**

This course is designed for students who have no knowledge of IsiZulu. It is offered in two consecutive terms. The course familiarises students with speaking, reading, writing and hearing IsiZulu. An understanding of grammatical structures is gradually through the close reading of simple graded texts. Students are taught to function in situations that require basic knowledge of IsiZulu.

Course Code: AFRL1005A**Course Description: Elementary Sesotho Language and Culture IA****NQF Credits: 18****NQF Level: 5**

This course is designed for students who have no knowledge of Sesotho. The courses familiarises students with speaking, reading, writing and hearing Sesotho. An understanding of grammatical structures is introduced through the close reading of simple graded texts. Students are taught to function in situations that require basic knowledge of Sesotho.

SCHOOL OF MATHEMATICS**Course Code: MATH1038A****Course Description: Mathematics (CS)****NQF Credits: 18****NQF Level: 5**

This course covers the following topics:

- 1) Vectors: Introduction; displacement vectors; unit vectors; multiplication by scalar; equal vectors; addition and subtraction of vectors; position vectors
- 2) Functions and Trigonometric functions: Functions and Graphs; Euclidean Geometry; trigonometric functions of any angle; radian measure; inverse trigonometric functions; sum and difference formulas; solving trigonometric functions
- 3) Derivatives and their Applications: Limits; slope of a tangent to a curve; the derivative as instantaneous rate of change; derivatives of polynomials; derivatives of products; derivatives of quotients; differentiation of implicit functions; Tangents and Normals; Related rates; using derivatives in Curve sketching; Applied Maximum and Minimum problems; differentials and linear Approximations
- 4) Integration and Applications: Anti-derivatives; Indefinite integral; Definite Integral; Area under a curve; integration by parts; volume by integration.

Course Code: MATH1039A**Course Description: Mathematics for Property Studies****NQF Credits: 18****NQF Level: 5**

The course provides business related quantitative skills to students; in preparation for the rest of the Property Studies degree; especially from the second year. The course covers the mathematical concepts and tools such as: Linear and quadratic equations with emphasis on their economic applications. Applications of inequalities in economics. Rules for differentiation and optimisation with one independent variable including points of inflection. Economic applications of functions and derivatives such as demand; cost; marginal and total revenue and profit maximization. Simple and compound interest and applications relating to fixed deposits; loan repayments and present value. Exponential and logarithmic functions with applications to discrete and continuous growth and discounting. Integration techniques. Matrix Algebra. Elementary differential equations.

Course Code: MATH1042A/MATH1046A (PT)**Course Description: Engineering Mathematics IA****NQF Credits: 18****NQF Level: 5**

This course provides the students with a basic foundation in differentiation and integration techniques and simple applications, binomial theorem and simple series.

- 1) The topics in Calculus 1A include: functions; domain and range of functions; composite functions; limits and continuity; differentiation; applications of differentiation (curve sketching, maxima & minima and rates of change); antiderivatives, definite and indefinite integrals; Riemann sums; applications of integration to areas and volumes; the natural logarithmic and exponential functions (transcendental functions).
- 2) The topics in Algebra 1A include: radian measure; trigonometric functions; trigonometric equations; polar coordinates; the principle of mathematical induction; binomial theorem; conic sections.

Course Code: MATH1043A/MATH1047A (PT)**Course Description: Engineering Mathematics IB****NQF Credits: 18****NQF Level: 5**

This course provides students with a basic foundation in differentiation and integration techniques and simple application, the solution of simple differential equations and matrices. The topics in Calculus 1B include: further techniques of integration and improper integrals; sequences and series; Taylor and Maclaurin series; L'Hôpital's rule; partial differentiation; ordinary first order differential equations.

The topics in Algebra 1B include: linear systems of equations; Gaussian elimination; matrix algebra; inverse matrices; determinants; inverse matrices by elementary row operations and adjoint-determinant method; Cramer's rule; dot product and cross product in $\mathbb{R}^3$; vector algebra in $\mathbb{R}^2$ and $\mathbb{R}^3$; lines and planes in $\mathbb{R}^3$; complex numbers; modulus-argument form of complex numbers; De Moivre's theorem; n -th roots.

Course Code: MATH2011A**Course Description: Mathematics II****NQF Credits: 27****NQF Level: 6****(27) (4-1-0) (2 terms)**

This course augments techniques and simple applications of the algebra and the calculus introduced in Mathematics 1A and Mathematics 1B. The course enhances students' ability to apply first principles of mathematics to solve engineering problems. Topics include complex numbers series and tests of convergence, linear algebra including eigenvalues and eigenvectors, diagonalisation, Cayley Hamilton theorem, linear differential equations, vector differentiation trajectories, quadric surfaces orthonormality, unitary and Hermitian matrices, Fourier series, directional derivatives, del operator, potential functions, stationary points on surfaces scalar and vector path integrals, double integrals, Green's theorem, regions in the Complex Plane, analyticity of complex functions and singularities.

Course Code: MATH2012A**Course Description: Mathematics II****NQF Credits: 27****NQF Level: 6****(15) (4-1-0) (1 terms)**

The course augments techniques and simple applications of the algebra and the calculus introduced in Mathematics 1A and Mathematics 1B. The course enhances students' ability to apply first principles of mathematics to solve engineering problems. Topics covered in this course include: Complex numbers; series and tests of convergence; linear algebra including eigenvalues and eigenvectors, diagonalisation, Cayley-Hamilton theorem; linear differential equations; vector differentiation; trajectories; and quadric surfaces.

Course Code: MATH2014A**Course Description: Mathematics II****NQF Credits: 33****NQF Level: 6****(33) (5-3/2-0) (2 terms)**

The course augments techniques and simple applications of the algebra and the calculus introduced in Mathematics 1A and Mathematics 1B. The course enhances students' ability to apply first principles of mathematics to solve engineering problems. Topics covered in this course include:

Semester one: complex numbers; series and tests of convergence; linear algebra including eigenvalues and eigenvectors, diagonalisation, Cayley-Hamilton theorem; linear differential equations; vector differentiation; trajectories; quadric surfaces; Laplace transforms and inverse Laplace transforms, solving differential equations; special functions; Fourier transforms; boundary value problems; orthonormality; unitary and Hermitian matrices; Fourier series; directional derivatives; del operator; potential functions; stationary points on surfaces; scalar and vector path integrals; double integrals; Green's theorem; regions in the Complex Plane; analyticity of complex functions; and singularities.

Course Code: MATH2026A**Course Description: Mathematics II****NQF Credits: 13****NQF Level: 6****(13) (3-.75-0) (1 term)**

The course augments techniques and simple applications of the algebra and the calculus introduced in Mathematics 1A and Mathematics 1B. The course enhances students' ability to apply first principles of mathematics to solve engineering problems. Topics covered in this course include: complex numbers, series, linear space, orthonormality, linear equations and operators, d-operators, complementary functions, particular integrals, complex exponentials, stability, vector differentiation, curvature torsion, trajectories and quadric surfaces.

Course Code: MATH3025A**Course Description: Mathematical Methods (Electrical)****NQF Credits: 15****NQF Level: 7****(15) (4-1-0) (1 term)**

In this course students acquire more advanced techniques for dealing with surface and volume integrals and a sound basis knowledge of complex variable theory including transformations.

- 1) Complex variable and integral theorems: This section involves analytic functions and conformal transformations. Ideal flow in the plane. Surface and volume integrals. Gauss' divergence theorem and Stokes' theorem.
- 2) Applied Complex Variable: This section covers contour integration and Cauchy's integral theorems and Taylor series. Singularities and Laurent series. The residue theorem and inversion of Laplace transforms.

Course Code: MATH3026A**Course Description: Mathematical Methods (Aero and Mech)****NQF Credits: 15****NQF Level: 7****(15) (4-1-0) (1 term)**

In this course students acquire more advanced techniques for solving differential equations; dealing with complex transformations and surface and volume integrals.

- 1) Transforms and Special Functions: This section includes the theory and applications of Laplace and Fourier transforms. Special functions. Boundary value problems involving certain partial differential equations.
- 2) Complex variable and integral theorems: This section involves analytic functions and conformal transformations. Ideal flow in the plane. Surface and volume integrals. Gauss' divergence theorem and Stokes' theorem.

Course Code: MATH3036A**Course Description: Mathematical Methods (Industrial)****NQF Credits: 9****NQF Level: 7****(7) (2-0-0) (1 term)**

The course covers mathematical methods in Industrial Engineering, including: a basic understanding of Laplace transformations; linear programming including the simplex method, duality, sensitivity analysis and the branch and bound algorithm; game theory topics such as the Prisoner's dilemma; Markov Chains topics such as steady-state probabilities and ergodic chains.

SCHOOL OF MECHANICAL, INDUSTRIAL AND AERONAUTICAL ENGINEERING**Course Code: MECN1004A****Course Description: Selected Topics in Social Science****NQF Credits: 12****NQF Level: 5****(12) (3-0-0) (1 term)**

The course introduces engineering students to various aspects of the Social Sciences. The course presents a combination of introductory analytical concepts and some descriptive studies as applied in one or two of the topics listed below.

The course covers one or two selected topics in: Anthropology; Developmental studies; history; international relations; philosophy; political studies; population studies; labour policy; globalisation and sociology.

Course Code: MECN1996A**Course Description: Engineering Professional Activity****NQF Credits: 0****NQF Level: N/A**

Students in the final year are to demonstrate 'critical awareness of the need to act professionally and ethically and to exercise judgment and take responsibility within their own limits of competence as required by ECSA ELO 10. Each student is to undertake School related work under the direction; and to the satisfaction; of one or more staff members. Students are allocated to various duties including; but not limited to; tutoring and demonstration duties.

Course Code: MECN1998A**Course Description: Vacation Work I (Mechanical)****NQF Credits: 0****NQF Level: N/A**

The first segment of vacation work may be done at the end of first and/or second year; totalling not less than six weeks (at least four weeks continuous). It should be completed before the student enters the third year of study; enabling students to obtain practical experience of engineering processes; according to the departmental guidelines for vacation work. A minimum of two weeks of the vacation work should be dedicated to obtaining suitable; direct; practical exposure. This needs to take place in the context of direct involvement in activities such as maintenance; construction; practical operations; etc; that might typically take place in the field or in workshops. Those who do not satisfactorily complete this practical component of the vacation work will be obliged to undergo a two week workshop training course at their own expense; before the conclusion of the degree programme. Provision for this will be made during the third year mid-year break; in the School of Mechanical; Industrial and Aeronautical Engineering workshops. If suitable practical training has already been undertaken; then exemption from this one component of vacation work may be obtained. The six week requirement remains unchanged. Requirements for satisfactory completion of vacation work are: - the submission of a vacation work certificate confirming that students have completed their work regularly and satisfactorily during the prescribed period; and a report on the work undertaken during the period of vacation employment.

Course Code: MECN1999A**Course Description: Vacation Work II (Mechanical)****NQF Credits: 0****NQF Level: N/A**

This course is designed to complement the theoretical nature of the engineering curriculum to give students insight into the practical application of theory in industry and assist in developing sound engineering practice. The second period of vacation work should be completed during a period of six consecutive weeks after obtaining credit for the third year of study. Where possible the vacation work should take place in industry; enabling the student to obtain experience on project work in an industrial environment. This work should follow the departmental guidelines for vacation work. Requirements for satisfactory completion of vacation work:- are the submission of a vacation work certificate confirming that students have completed their work regularly and satisfactorily during the prescribed period; and a report on the work undertaken during the period of vacation employment.

Course Code: MECN2025A**Course Description: Engineering Design****NQF Credits: 15****NQF Level: 6**

This course introduces engineering design and focuses on developing and applying problem solving skills to engineering design problems. Topics include problem investigation and identification, the role of system requirements, solution development and assessment strategies, problem solving approaches, consideration of alternative options during the designs development, appropriate application of engineering sciences to a design problem and technical communication. The course also covers Individual and group design projects resulting in detailed designs with manufacturing drawings.

Course Code: MECN2026A**Course Description: Machine Elements****NQF Credits: 9****NQF Level: 6**

This course introduces the design of machine components and focuses on developing and applying theories of stress analysis and failure to engineering design problems. Topics include fundamental analysis and design of standard machine elements and assemblies, application of shear force and bending moment diagrams, stress analysis and principal stresses and Mohr's circle in static and fatigue failure, factors of safety and analysis and sizing of various mechanical components.

Course Code: MECN2005A**Course Description: Mechanical Engineering Laboratory I****NQF Credits: 12****NQF Level: 6****(9) (0.5-0-1) (2 terms)**

This course lays a firm foundation for future experimental studies crucial to both the following third year laboratory course and the final year research projects. The course is also aimed at promoting the accurate communication of experiment results and this is dealt with in detail in the lectured part of the course. The course consists of:

Coursework: Planning; conduct and reporting of experiments; experimental errors; graphical analysis and curve fitting; dimensional analysis. Introduction to measurement systems and instruments. Analogue and digital operation; calibration; system response. Strain gauges.

Laboratories: A series of practical laboratory experiments to apply material from the engineering science courses and International Standards in a multi-disciplinary format that is independent of the engineering science units.

Course Code: MECN2010A/MECN2016A (PT)**Course Description: Introduction to Materials Science and Engineering****NQF Credits: 12****NQF Level: 6**

(12) (3-1-0) (1 term)

This course provides students with a fundamental scientific background to materials behaviour against which rational choices of types of materials for particular applications may be made. It aims to give students an understanding of how material properties impose limitations on the behaviour of engineering components. The course covers: Classification of materials; materials design and selection; atomic structure and bonding; crystal structures; defects in atomic and ionic arrangements; diffusion; mechanical properties; failure of materials; strain hardening and annealing; solidification; solid solutions; dispersion strengthening and eutectic phase diagrams; phase transformations and heat treatments; steels and cast irons; nonferrous alloys; ceramic materials; polymers

Course Code: MECN2011A/MECN2019A (PT)
--

Course Description: Applied Mechanics A
--

NQF Credits: 15

NQF Level: 6

(15) (4-1-0) (1 term)

This course focuses on the analysis of forces applied to structures and machines in equilibrium; and to understand the behaviour of physical bodies when subjected to forces and displacements. This course is made up of mechanics of solids and statics. The mechanics of solids section involves deriving and applying: the flexure formula in beams; the torsional formula in circular shafts and the transformation of two-dimensional stress elements (Mohr's circle). The mechanics of solids section further covers: solving statically indeterminate problems (axial loads and torsion); determining the stresses and strains associated with thermal loading; and solving combined loading problems. The statics section involves applying equations of equilibrium to two-dimensional frames and machines and three-dimensional space trusses.

Course Code: MECN2012A/MECN2017A (PT)
--

Course Description: Computing Skills and Software Development
--

NQF Credits: 15

NQF Level: 6

(15) (2-0-3) (1 term)

The course introduces students to key concepts in programming logic and the development of programs using high-level languages and common applications. These concepts are explored using examples in engineering science including data management. The course consists of: History and Fundamentals: Basic history of computing; number systems; logical and boolean operators; algorithms; generic program structure; design; and flowcharting.

Programming (modern high-level language MatLab or equivalent): Algorithms; sequence; branching; and looping; functions and scripts; data structures; plotting; file handling. Program creation; testing and debugging. Integration of objects and/or modules into higher level programs.

Computer Software: spreadsheets (e.g. Microsoft Excel; including macros) and document preparation (LaTeX).

Practical exercises: applications of programming and spreadsheets in analysis of simple engineering systems.

Course Code: MECN2013A

Course Description: Applied Mechanics B
--

NQF Credits: 15

NQF Level: 6

(15) (4-1-0) (1 term)

This course will provide the students with competencies required to analyse rigid bodies undergoing plane motion. It aims to introduce students to the basic principles required to analyse the geometrical aspects of the motion and to study the relationship between the forces acting on rigid bodies and the resulting motion. It further aims to promote analytical and systematic problem-solving skills required to solve a wide variety of real engineering problems.

The course consists of:

Kinematics: Kinematics of particles: rectilinear and plane curvilinear motion; motion relative to translating and rotating axes: plane kinematics of rigid bodies (simple planar mechanisms).

Kinetics: Kinetics of a single particle; and of systems of particles; Newton's second law-equation of motion; work-energy and impulse-momentum equations; plane kinetics of rigid bodies; translation; fixed-axis rotation and general plane motion.

Course Code: MECN2022A/MECN2033A (PT)

Course Description: Fluid Mechanics

NQF Credits: 12

NQF Level: 6

(12) (3-1-0) (1 term)

This course introduces key concepts relating to analysis and modelling of various fluid flow systems. It focuses on the fundamental aspects of fluid mechanics necessary for open-ended problem solving. The course consists of the following core topics:

- 1) Fluid statics: pressure distribution; fluids in relative equilibrium.
- 2) Viscous flow: laminar and turbulent flow distinction pressure drop and friction factor;
- 3) Fluid dynamics: continuity equation; euler equations; Bernoulli equation; pressure and flow measurement;
- 4) Hydraulics: yurbulent pipe flow; minor component losses. pipe networks.
- 5) Forces on submerged surfaces: hydrostatic forces; conservation of linear and angular momentum

Course Code: MECN2024A/MECN2021A (PT)

Course Description: Engineering Thermodynamics I

NQF Credits: 12

NQF Level: 6

(12) (4-0-0) (1 term)

This course introduces fundamental concepts of classical engineering thermodynamics including relationships among the properties of matter and the laws governing the transformation of energy into various forms. Central to this course is developing an understanding of the law of conservation of energy (First Law of Thermodynamics) and the law of degradation of energy (Second Law of Thermodynamics).

The course covers: Introductory concepts and definitions; energy and the First Law of thermodynamics; properties of simple substance; the Second Law of thermodynamics ;entropy the application of thermodynamic principles and the use of property relations in the analysis of thermodynamic processes; cycles and systems.

Course Code: MECN3040A

Course Description: Aeronautical Engineering Investigation

NQF Credits: 15

NQF Level: 7

(15) (0-0-5) (2 terms)

This course focuses on developing the skills required in the planning, execution and communication of investigative studies and leads to a firm foundation for the final year independent research project. The course consists of experimental methods, data acquisition and analysis, safety in the laboratory, report-writing and professional communication, introduction to selected software packages, scheduled investigational assignments on selected topics in aeronautical, industrial and mechanical engineering and experimental assignments or open-ended projects of an experimental nature specific to aeronautical engineering

Course Code: MECN3004A

Course Description: Industrial Engineering Design

NQF Credits: 27

NQF Level: 7

(27) (2-0-5) (2 terms)

This course allows students to experience a realistic approach to engineering design through exposure to open-ended; interdisciplinary; design problems which encourage judgmental skills and teamwork. It aims to give students the ability to solve complex problems and communicate solutions through project reports and presentations. The course requires students to provide solutions that integrate materials provided by this course and other academic courses within their curriculum. The course syllabus includes topical material including: the design process; the engineering enterprise; problem solving and decision making; the interaction of design; materials and manufacture; cost evaluation; optimisation; computer modelling; information sources; design communication; work study and ergonomics. The course includes complimentary visits to organisations in industry.

Course Code: MECN3042A
Course Description: Industrial Engineering Investigation
NQF Credits: 15
NQF Level: 7
(15) (0-0-5) (2 terms)

This course focuses on developing skills for the planning, execution and communication of investigative studies and leads to a firm foundation for the independent final year research project. The course consists of experimental methods, data acquisition and analysis, safety in the laboratory, report writing and professional communication, introduction to selected software packages, scheduled investigational assignments on selected topics in aeronautical, industrial and mechanical engineering and experimental assignments or open-ended projects of an experimental nature specific to Industrial engineering.

Course Code: MECN3041A
Course Description: Mechanical Engineering Investigation
NQF Credits: 15
NQF Level: 7
(15) (0-0-5) (2 terms)

This course focuses on developing the skills for the planning, execution and communication of investigative studies and leads to a firm foundation for the final year independent research project. The course consists of experimental methods, data acquisition and analysis, safety in the laboratory, report writing and professional communication, introduction to selected software packages, scheduled investigational assignments on selected topics in aeronautical, industrial and mechanical engineering and experimental assignments or open-ended projects of an experimental nature specific to mechanical engineering.

Course Code: MECN3008A
Course Description: Introduction to Aeronautics
NQF Credits: 9
NQF Level: 7
(9) (3-0-0) (1 term)

This course introduces the student to the key concepts of aircraft performance and stability estimation. It does this by introducing the student to aerodynamic forces and moments at all stages of aircraft flight. The student develops the ability to determine the endurance; range; climb; descent and turn performance of any aircraft. The student is able to estimate the performance and static stability for the entire flight envelope for any fixed-wing aircraft. Important minimum control speeds are determined with the associated control forces and control surface deflection. The performance of rotary-wing aircraft is introduced in the course;

Course Code: MECN3010A
Course Description: Mechanics of Solids I
NQF Credits: 15
NQF Level: 7

(15) (4-1-0) (1 term)

The course extends the fundamental knowledge gained in Applied mechanics-A by considering the inelastic material behaviour and complex bending and torsional loads. It also focuses on calculating shear stress in beams; deflection of beams and buckling of columns. It further introduces energy methods and virtual work for calculating slope and deflection of frames and trusses under various loading conditions.

Course Code: MECN3012A

Course Description: Mechatronics I

NQF Credits: 15

NQF Level: 7

(15) (3-0-2) (1 term)

This course will introduce students to the fundamentals needed to design; model; and analyse mechatronic systems. Students will gain practical experience in the design of mechatronic systems through laboratory exercises and a practical project. The course covers the following main topics:

- 1) Introduction to mechatronics
- 2) Synergistic use of pneumatic; hydraulic; mechanical; electrical; and electronic actuation in mechatronic system applications
- 3) Measurement systems; theory and analysis
- 4) Elementary automatic control

Course Code: MECN3013A

Course Description: Business Management

NQF Credits: 12

NQF Level: 7

(12) (3-0-0) (1 term)

This course introduces the engineering student to business by considering how it is managed beginning with the initial business idea and how it is influenced by quality of the idea; the business environment; controls within the business; economic decisions and risk evaluation. Emphasis is placed on the firm as a business entity and the complex nature of decisions involved thereat; with tools provided that can be used. Topics cover economics; financial accounting; budgeting (including marketing); the engineer and the environment.

Course Code: MECN3014A

Course Description: Operations Management: Techniques

NQF Credits: 15

NQF Level: 7

(15) (4-0-0) (1 term)

This course gives students exposure to principles of operations management and fundamental theory and techniques in core operations management elements. It aims to give students the ability to understand the impact of operations management on organisational strategy and equips students with the skills to use various operations management techniques. The course syllabus includes the following topics: introduction to operations management; production planning and control systems; measures of performance (productivity concepts); techniques for process and facilities planning; inventory; forecasting; supply chain management; statistical methods for process control and quality.

Course Code: MECN3025A

Course Description: Manufacturing Technology: Processes

NQF Credits: 12

NQF Level: 7

(12) (4-0-0) (1 term)

This course provides students with an introduction to manufacturing and production technology; develop skills for solving open-ended manufacturing-related problems; expose you to a number of interdisciplinary problems related to design-materials-manufacturing; and encourage creative and imaginative problem solving. The course consists of the following Topics in manufacturing technology processes:

- 1) Engineering design relevant to manufacturing processes: dimensional and geometrical tolerances; design and manufacturing datums; quality and manufacturing processes; surface roughness and manufacturing processes; design-for-manufacturing; design production relationships; design for specific manufacturing processes.
- 2) Manufacturing processes: casting; glass-working; shaping processes for plastics; bulk metal deformation processes; sheet metal forming; powder metallurgy; conventional machining processes; metal cutting theory; nonconventional machining processes; cutting tools and the economics of cutting; coating and deposition processes.

Course Code: MECN3026A

Course Description: Principles of Organisational Behaviour

NQF Credits: 9

NQF Level: 7

(9) (3-0-0) (1 term)

This Organisational Behaviour course introduces the Industrial Engineering student to the key theoretical concepts embraced by the discipline and its current applications in the contemporary workplace. Study focus is on the way in which workplace efficiency can be improved using the individual; the team/group and the organisation as a means of achieving this outcome. The course syllabus entails an in-depth; critical exploration of the following 7 key areas; personality and behaviour; attitudes; values and motivation; conflict and negotiation; power and leadership; organisational culture; communication; and principles of management.

Course Code: MECN3027A

Course Description: Mechanical Vibrations

NQF Credits: 15

NQF Level: 7

(15) (4-1-0) (1 term)

This course focuses on mechanical vibrations and covers derivation and solution of the mathematical equations governing vibrating systems. Topics include:

- 1) Introduction to mechanical vibrations: basic concepts; mathematical solution of equations.
- 2) Single degree of freedom systems: free vibration (damped and undamped); harmonic; periodic and impulsive excitation (damped and undamped).
- 3) Vibration control: vibration isolation; balancing of rotating equipment; vibration absorption.
- 4) Two degree of freedom systems: equations of motion; free and forced vibration; natural frequencies and mode shapes.
- 5) Vibration measurement and applications: Practical vibration measurement and machinery fault diagnosis.

Course Code: MECN3028A

Course Description: Engineering in its Social Context

NQF Credits: 18

NQF Level: 7

(18) (3-0-0) (1 term)

This course enables students to understand how and why engineering is socially constructed and embedded; to identify environmental and social concerns in project design and implementation; and to appreciate the way that engineering relates to; and is impacted by; society. The material will be presented during formal lectures and supplemented with self-study.

- 1) The initial six weeks of this course introduces the Engineering student to Western and African moral philosophical approaches as a means of providing an understanding of how and why the profession of engineering is socially constructed and embedded. During this initial introduction the course exposes the student to the skills of critical thinking and systematic argumentation as an objective means of positively engaging with other engineering professionals and the public when faced with project design and implementation that might embrace environmental and social concerns.

- 2) The second part of the course examines the practical application of theory by examining: The role and function of the Engineering Council of South Africa (ECSA); the primary duties of an engineer using the frameworks of risk and safety; engineering case studies which illustrate ethical dilemmas for professional engineers; the role and function of whistleblowing within the engineering profession.

Course Code: MECN3030A

Course Description: Operations Research

NQF Credits: 15

NQF Level: 7

(15) (4-0-0) (1 term)

The Operations Research course will provide students with the competencies needed to analyse; model and optimise an organisation's processes. It aims to give students an understanding of how to select and apply mathematical modelling techniques in different business contexts and to contribute to the optimisation of the performance of organisations. The course syllabus contains the following:

Mathematical programming: Mathematical programming problems; optimisation; linear programming; post-optimality analysis; networks; integer programming; dynamic programming; non-linear and constraint programming; metaheuristics.

Course Code: MECN3031A

Course Description: Mathematical Topics (Industrial)

NQF Credits: 18

NQF Level: 7

(18) (3-0.5-0) (2 terms)

This course provides the students with a broad foundation in numerical methods and statistics as applied in engineering. This course is made up of the following components:

- 1) Numerical Module: Direct and iterative methods for linear algebraic equations; iterative methods for nonlinear equations; polynomial interpolation and least squares approximation; numerical differentiation; Richardson's extrapolation; numerical integration. Numerical solution of ordinary differential equations (initial and boundary value problems).
- 2) Statistical Module: Descriptive statistics (graphical representation of data; measures of location; measures of variability); probability theory (Random experiments and random events); probability of random events; conditional probability; independence; random variables; random vectors; mathematical statistics (point estimation; interval estimation); parametric tests; non parametric tests; correlation analysis; linear regression.

Course Code: MECN3032A

Course Description: Numerical Methods and Statistics

NQF Credits: 18

NQF Level: 7

(18) (3-0.5-0) (2terms)

This course provides the students with a broad foundation in numerical methods and statistics as applied in engineering. This course is made up of the following components:

- 1) Numerical: Direct and iterative methods for linear algebraic equations; iterative methods for nonlinear equations; polynomial interpolation and least squares approximation; numerical differentiation; Richardson's extrapolation; numerical integration; numerical solution of ordinary differential equations (initial and boundary value problems).
- 2) Statistical: Descriptive statistics (graphical representation of data; measures of location; measures of variability); probability theory (Random experiments and random events); probability of random events; conditional probability; independence; random variables; random vectors; mathematical statistics (point estimation; interval estimation); parametric tests; nonparametric tests; correlation analysis; linear regression.

Course Code MECN3033A**Course Description: Introduction to Nuclear Engineering****NQF Credits: 30****NQF Level: 7**

This course introduces the student to the basics of nuclear engineering regarding energy production from fissile nuclear material and energy conversion (nuclear to thermal to electric). The course covers the design of nuclear power reactors; reactor control; reactor shielding and the extraction of heat in the thermal cycle. The course will also cover basic heat transfer and an introduction to measurement theory and practice; as applied to nuclear power. This will include practical laboratory experiments as part of an investigational project where material from the course is applied.

Course Code: MECN3034A**Course Description: Introduction to Nuclear Safety****NQF Credits: 30****NQF Level: 7**

This course introduces the student to the basics of safe application of nuclear engineering. The course looks at: safety assessment of nuclear reactors; operation safety; reactor accidents; philosophy and rules of design for safety. The course also covers a case study of severe accidents; root cause analysis; and failure mode and criticality analysis as part of an investigational project.

Course Code: MECN3035A**Course Description: Aircraft Structures I****NQF Credits: 12****NQF Level: 7****(12) (4-0-0) (1 term)**

The course consists of two components. The first considers semi-monocoque structures; the second considers composite materials and structures. The objective of the first component is to introduce the principles involved in semi-monocoque structures and the methods of their analysis. This component comprises sections on the principles of stressed-skin structures; bending; torsion and shear in semi-monocoque structures; instability and post-buckling behaviour of stiffened plate structures; and semi-tension fields. The objective of the second component is to cover techniques for the analysis and design of composite structures of the types typically encountered in aerospace vehicles. This component comprises sections on an introduction to materials; micromechanics; macromechanics; failure theories; Classical Lamination Theory; and composites as used in aircraft structures.

Course Code: MECN3036A**Course Description: Incompressible Flows****NQF Credits: 12****NQF Level: 7****(12) (3-1-0) (1 term)**

This course introduces general fluid dynamic analysis of external flows around solid bodies. A physical understanding of unconfined flows over solid objects is developed via semi-empirical analyses and interpretation. It further develops an understanding of classical potential flow and boundary layer flow analyses through mathematical models and analytical solutions for a number of specific fluid flow situations. The course covers:

Momentum transfer as lift and drag and the Euler turbomachine equations, potential flows, boundary layer flow and highly viscous flows with applications in fluid bearings.

Course Code: MECN3037A**Course Description: Fundamentals in Engineering Heat Transfer****NQF Credits: 12****NQF Level: 7**

This course introduces the underlying concepts of engineering heat transfer relating to the physical and mathematical analysis and modelling. The topic focuses on the fundamental aspects of engineering heat transfer in three broad modes such as conduction, convection and radiation. The course, in particular, consists of; introduction to energy systems and governing equations; principles of convective heat transfer with engineering applications; principles of conductive heat transfer with engineering applications; principles of radiative heat transfer with engineering applications; innovative designs of heat exchangers and heat dissipation elements.

Course Code: MECN3043A

Course Description: Manufacturing Processes

NQF Credits: 9

NQF Level: 7

This course reinforces the fundamentals of manufacturing processes. The course consists of an introduction to manufacturing, engineering drawing related to manufacturing, surface texture and dimensional and geometric tolerances, materials and heat treatments, engineering metrology, casting and forming processes, powder metallurgy, sheet metal forming, metal cutting, cutting tools, economics of cutting, conventional and unconventional machining, computer numerical control (CNC), machining, automation and robotics and computer integrated manufacturing (CIM).

Course Code: MECN3038A

Course Description: Aeronautical Engineering Design

NQF Credits: 21

NQF Level: 7

This course introduces the design of aeronautical vehicles and reinforces engineering design for complex systems. The course consists of design processes for aeronautical vehicles, general rules and regulation, applied aerodynamics of low and high-speed flight, introduction to supersonic aerodynamics and aircraft systems. The course also explores the links between synergistic design process with the atmosphere, aerodynamics, propulsion, stability, controllability and aeronautical structures.

Course Code: MECN3039A

Course Description: Mechanical Engineering Design

NQF Credits: 21

NQF Level: 7

This course reinforces the fundamentals of mechanical engineering design of complex systems. The course is made up of two components. The first component consists of machine design which is further divided into mechanical transmission design (belts, chains, gears, shaft design (including deformation analysis and critical speed analysis), bearings, cams and springs, linkages and mechanisms. The second component consists of the design process which is further divided into design methodologies, design approaches for various particular mechanical systems, machines and components, analysis tools and skills used in the design process.

Course Code: MECN4005A

Course Description: Design Project

NQF Credits: 39

NQF Level: 8

(39) (8 weeks; full time)

This course provides students with an opportunity to exercise and demonstrate the ability to coordinate knowledge; experience and judgement in addressing a major open-ended design problem. This involves: understanding the context of the problem; planning a course of action; applying design methodology; concept development and selection; detailed analysis and design; and presenting the proposed solution in writing; by means of detailed engineering drawings and orally.

Course Code: MECN4006A

Course Description: Research Project

NQF Credits: 39

NQF Level: 8

(39) (8 weeks; full time)

This course provides students with an opportunity to plan and carry out a challenging investigational project. This involves: understanding the problem so as to be able to define appropriate and specific objectives; planning a course of action to obtain necessary information; in terms of both existing knowledge and new experimental data; carrying out the planned programme; interpreting the results and drawing conclusions in terms of the objectives; and reporting effectively on the project; both in writing and orally.

Course Code: MECN4009

Course Description: Manufacturing Technology: Systems

NQF Credits: 15

NQF Level: 8

(15) (4-0-0) (1 term)

The course develops skills for solving open-ended manufacturing-systems related problems. Students are exposed to: a number of selected manufacturing-systems topics that are currently used in industry; a number of interdisciplinary problems related to manufacturing systems; problems that require creative and imaginative problem solving; and the practical application and management of technology used in manufacturing industry. Topics covered in the course include:

Computer numerical control (CNC) machining; production systems; production quantity and product variety; automation and robotics; materials handling; business modelling; production concepts; computer aided process planning (CAPP); rapid product development; biomimetics; sustainable development; and the changing manufacturing innovation scene.

Course Code: MECN4015A

Course Description: Business Studies

NQF Credits: 12

NQF Level: 8

(12) (3-0-0) (1 term)

The course allows students to integrate technical and complimentary work in Industrial Engineering in a capstone group project; the outcome usually being a business plan. It is intended to help the student integrate his/her knowledge for creating business plans for themselves or for organisations that employ them and gives the student a basis to interact with other professionals found in the business. Students work in groups to solve more advanced engineering problems; apply knowledge in design and synthesis using engineering methods; and generate the impact of their activity on society and the environment in an ethical manner. Groups demonstrate their ability to learn by themselves through investigation (including complementary topics); experiments and data analysis; and communicate such knowledge professionally. This integrates and emphasises earlier complementary studies in the curriculum. A business plan is usually assigned.

Course Code: MECN4020A

Course Description: Systems Management and Integration

NQF Credits: 12

NQF Level: 8

(12) (3-0-0) (1 term)

This course introduces students to the principles of project management; systems engineering management; systems thinking and general management. These topics are divided into two distinct sections with project management comprising the first; and the other topics making up the second section. The course focuses on theory; techniques and application of these principles in case studies and projects; and exposes the student to multi-disciplinary engineering activities.

Course Code: MECN4023A

Course Description: Mechanics of Solids II

NQF Credits: 15

NQF Level: 8

(15) (3-1-0) (1 term)

This course focuses on completing the basic knowledge required to analyse stresses in a variety of commonly encountered mechanical structures. The course comprises two main parts. The first part aims to equip students with the necessary skills for planning and conducting a Finite Element Analysis (FEA) of mechanical structures; the second part aims to expose the students to the mechanics and manufacturing technology of composite materials. The course consists of:

- 1) Finite Element Analysis (FEA): typical fields of application of FEA; basic concepts and significance; typical steps; definition of finite elements; generation of element and global stiffness matrices; FEA system of equations; imposition of boundary conditions; solving systems of equations; calculation of reaction forces; stresses and strains; FEA formulation for elasto dynamic problems; principle of virtual work; numerical integration method; Gauss quadrature; isoparametric elements; Jacobian; modelling with commercial software of two and three-dimensional problems in linear structural and thermal analyses consisting of idealisation; modelling; solution; results displaying; applications of FEA to practical problems.
- 2) Mechanics of Composite Materials: materials; manufacturing methods; micromechanics; macro mechanics of a lamina; failure criteria; laminate analysis; design of composite structures.

Course Code: MECN4024A

Course Description: Gas Dynamics and Propulsion

NQF Credits: 15

NQF Level: 8

(15) (4-0-0) (1 term)

This course applies material from previous Fluid Mechanics and Thermodynamics courses to gain an understanding of, and a working familiarity with, advanced concepts. It covers propulsion systems and compressible flows. Students are introduced to the analysis of aircraft propulsion systems and one-dimensional compressible flow fields including friction and thermal effects as well as some elements of two-dimensional gas dynamics. The course also includes an introduction to the application of modern computational fluid dynamics (CFD) through the use of a common commercial CFD package.

Course Code: MECN4025A

Course Description: Aerodynamics

NQF Credits: 12

NQF Level: 8

(12) (3-0-0) (1 term)

This course focuses on the following topics:

Zhukowski and other two-dimensional aerofoils; Kutta condition. Thin aerofoil theory; symmetric fairing theory; finite wing theory; downwash and interference effects. Linearised two-dimensional compressible flow; similarity laws; thin aerofoils in supersonic flow. Application of Navier-Stokes equations. Introduction to turbulence; mixing length theory; universal velocity distribution. Computational aerodynamics: The panel method and applications.

Course Code: MECN4026A

Course Description: Flight Dynamics

NQF Credits: 12

NQF Level: 8

(12) (3-0-0) (1 term)

This course focuses on the following topics:

Definitions. Longitudinal static and manoeuvring stability; stick fixed and stick free: elevator and tab deflections; stick force; flight tests; all moving tail planes; propulsion and other effects; cg limits. Elementary lateral and directional stability. General equations of motion. Axes systems. Small disturbance theory. Non-dimensional equations. Stability derivatives. Solution of equations. Longitudinal and lateral-directional dynamic stability and response; stability diagrams. Introduction to automatic control.

Course Code: MECN4027A**Course Description: Aircraft Structures II****NQF Credits: 12****NQF Level: 8****(12) (3-0-0) (1 term)**

This course is a follow-on course from the prerequisite course Aircraft Structures I and continues the presentation and application of important concepts in this field. The course comprises five sections.

- 1) Semi-monocoque structures includes load introduction; cut outs; and loads on fuselage frames and wing ribs.
- 2) Energy methods of structural analysis including the calculation of loads; deflections; natural frequencies and buckling loads using complementary energy methods and the Rayleigh-Ritz technique.
- 3) Finite element methods (FEM) and includes the theory of finite element analysis; F.E. modelling techniques; and the use of F.E.M. software.
- 4) Aeroelasticity is the topic of the fourth section which includes static phenomena including divergence and control reversal; lifting surface flutter and control surface flutter.
- 5) The course concludes with a section on fracture mechanics and its application to damage tolerant aircraft structures.

Course Code: MECN4028A**Course Description: Decision Support and Intelligence Systems****NQF Credits: 15****NQF Level: 8****(15) (4-0-0) (1 term)**

This course provides students with the competencies needed to analyse and model processes using an organisation's data. It enables understanding of how to select and apply decision support techniques and systems in different business contexts and to contribute to the optimisation of the performance of organisations. Topics include: Probability theory; probability distributions; queuing and simulation modelling techniques; Artificial Intelligence and machine learning techniques and an introduction to simulation and machine learning software.

Course Code: MECN4029A**Course Description: Mechatronics II****NQF Credits: 15****NQF Level: 8****(15) (4-0-0) (1term)**

This course focuses on the following topics:

- 1) Background and philosophy of Mechatronics; System Response and Control
- 2) Basic Control Concepts and Model Types: dynamic system performance; mathematical models of electrical; hydraulic and mechanical systems; linearisation and its limitations; introduction to the advantages of feedback.
- 3) Systems Response: free and forced responses of first- and second-order systems; step; ramp and sinusoidal response patterns.
- 4) Transfer Functions and Frequency Response Methods: Laplace transform and their application to solving linear; constant-coefficient differential equations; transfer functions; frequency response and Bode plots.
- 5) Feedback Control System Characteristics: open- and closed-loop control systems; sensitivity to parameter variations; transient response of controlled systems; disturbance signals in control systems.
- 6) System Performance Specifications: types of performance specifications (time- and frequency-domain).

- 7) Stability of Linear Feedback Systems: types of stability; mathematical conditions of stability; gain and phase margins; root locus plots.
- 8) Dynamic Responses of Systems with Control Elements: concepts of feedback control; general control system structure; control laws of on-off; proportional; integral and derivative control; design of closed-loop; feedback controllers; feed-forward and cascade schemes.

Course Code: MECN4030A

Course Description: Operations Management: Systems Integration

NQF Credits: 16

NQF Level: 8

(15) (4-0-0) (1 term)

This course introduces a broad range of issues that affect engineering managers in the field of manufacturing and service operations. The first part of the course focuses on the theory and techniques of strategy in operations. Since most of this field is contemporary a discussion-based, multi-media case study approach is primarily applied. The second part of the course builds on the principles and techniques of modern statistical quality control methods where advanced topics such as design of experiments and ANOVA are covered.

Course Code: MECN4031A

Course Description: Compressible Flows

NQF Credits: 15

NQF Level: 8

(15) (4-0-0) (1 term)

This course applies material from previous fluid mechanics and thermodynamics courses to gain an understanding of, and a working familiarity with, advanced concepts in fluid dynamics. Within this scope, the topics covered are turbomachines, turbulence and compressible flows.

Students are introduced to the analysis of turbomachines in engineering applications as well as to the analysis of one-dimensional compressible flow fields including friction, thermal effects and turbulence. The course also includes an introduction to the application of modern computational fluid dynamics (CFD) through the use of a common commercial CFD package.

Course Code: MECN4032A

Course Description: Energy Conversion and Utilisation Systems

NQF Credits: 15

NQF Level: 8

This course introduces key concepts of energy conversion and utilisation systems relating to the analysis and modelling in applications. It covers: internal combustion engines; gas turbines for power generation; steam power plants; combustion for power generation; air conditioning & refrigeration; Wind turbines.

Course Code: MECN5002A

Course Description: Operations Management

NQF Credits: 20

NQF Level: 8

The course focuses on theory and techniques of operations management and strategy in operations; including capacity strategy; supply network strategy; technology strategy and quality strategy. The course also covers the principles and techniques of modern statistical quality control; that is; advanced topics such as Design of Experiments and ANOVA will be covered.

Course Code: MECN5003A

Course Description: Operations Research Methods

NQF Credits: 20

NQF Level: 8

This course covers:

- 1) IT systems analysis and decision making; random number theory; probability distributions; queuing and simulation modelling techniques; introduction to artificial intelligence; data handling. The course will include an introduction to selected software packages.

- 2) Mathematical programming: Mathematical programming problems; optimisation; linear programming; network models; dynamic programming; metaheuristics; integer programming.
- 3) Stochastic processes: probability theory; game theory; decision analysis.

Course Code: MECN5004A

Course Description: Manufacturing Technology Principles

NQF Credits: 20

NQF Level: 8

This course focuses on choice of manufacturing processes: comparison of metal forming; joining and finishing processes. Topics include:

- 1) Modern manufacturing technology: amongst others - composite manufacture; rapid product development.
- 2) Engineering design relevant to manufacturing processes - dimensional and geometrical tolerances; design and manufacturing datums; IT grades and manufacturing processes; surface roughness and manufacturing processes; design-for-manufacturing; design-production relationships; design for specific manufacturing processes. Manufacturing processes e.g. casting; glass-working; shaping processes for plastics; bulk metal deformation processes; sheet metal forming; powder metallurgy; conventional machining processes; metal cutting theory; nonconventional machining processes; cutting tools and the economics of cutting; coating and deposition processes; engineering metrology.
- 3) Advanced manufacturing processes - cold gas dynamic spray; pulsed (shock waves) spray process; friction welding.

Course Code: MECN5005A

Course Description: Systems Management

NQF Credits: 20

NQF Level: 8

This course introduces candidates to:

- 1) The principles of project management;
- 2) Systems engineering management; systems thinking and general management.

The course focuses on theory; techniques and application of these principles in case studies and projects; and exposes the candidate to multi-disciplinary engineering activities.

Course Code: MECN5006A

Course Description: Business Planning Studies

NQF Credits: 20

NQF Level: 8

This course assists candidates to integrate their knowledge for creating business plans for themselves or for organisations that employ them. It will give them a basis to interact with other professionals found in the business.

Course Code: MECN5007A

Course Description: Engineering Investigation

NQF Credits: 20

NQF Level: 8

This course prepares candidates for the application of engineering investigational methods. The course will cover investigational problem formulation; compiling; organising and critically reviewing literature; dividing problems into sub problems; identifying required data; variables and controls and data analysis. This course is to develop and demonstrate competence to apply the engineering investigational methods in order to design and conduct investigations and/or experiments; and to analyse and interpret the results. This will be carried out in the context of an investigational project.

Course Code: MECN5008A

Course Description: Aerodynamics

NQF Credits: 20

NQF Level: 8

This course focuses on the following topics:

- 1) Aerostatics. Aerodynamic forces and moments including drag and lift coefficients; drag on two-dimensional shapes; drag on three-dimensional shapes; lift and drag on an aerofoil.
- 2) Potential Flow: description of basic two-dimensional flow fields (source; sink; vortex; etc) using complex mathematics; synthesis of flows by superposition of basic flow elements; conformal mapping; circulation and lift; images.
- 3) Introduction to turbulence; mixing length theory.
- 4) Boundary Layer Flow: boundary layer (Prandtl) equations; Von Karman's momentum integral equation; Thwaites/Walz method for flows with pressure gradients; turbulent flow in boundary layers.
- 5) Zhukowski and other two-dimensional aerofoils; Kutta condition. Thin aerofoil theory; symmetric fairing theory; finite wing theory; downwash and interference effects. Blade element theory and applications. Introduction to wind tunnel testing.
- 6) Linearised two-dimensional compressible flow; similarity laws; thin aerofoils in supersonic flow.
- 7) Computational aerodynamics: The panel method and applications.

Course Code: MECN5009A

Course Description: Flight Dynamics and Control

NQF Credits: 20

NQF Level: 8

This course focuses on the following topics:

- 1) Aircraft geometry. Performance in steady flight of propeller and jet engine aircraft; endurance and range. Performance in accelerated flight; turns; take-off and landing. Longitudinal static and manoeuvring stability; stick fixed and stick free: elevator and tab deflections; stick force; flight tests; all moving tail planes; propulsion and other effects; cg limits. Elementary lateral and directional stability.
- 2) General equations of motion. Axes systems. Small disturbance theory. Non-dimensional equations. Stability derivatives. Solution of equations. Longitudinal and lateral-directional dynamic stability and response; stability diagrams.
- 3) Introduction to automatic control including: Basic Control Concepts and Model Types: dynamic system performance; linearisation and its limitations; introduction to the advantages of feedback.
- 4) Systems Response: free and forced responses of first- and second-order systems. Transfer Functions and Frequency Response Methods: Laplace transform and their application to solving linear; constant-coefficient differential equations; transfer functions; frequency response and Bode plots.
- 5) Feedback Control System Characteristics: open- and closed-loop control systems; sensitivity to parameter variations; transient response of controlled systems; disturbance signals in control systems.
- 6) Stability of Linear Feedback Systems: types of stability; mathematical conditions of stability; gain and phase margins; root locus plots.
- 7) Dynamic Responses of Systems with Control Elements: concepts of feedback control; general control system structure; control laws of on-off; proportional; integral and derivative control; design of closed-loop; feedback controllers; feed-forward and cascade schemes.

Course Code: MECN5010A

Course Description: Aircraft Structures

NQF Credits: 20

NQF Level: 8

This course focuses on the principles involved in the design and analysis of semi-monocoque and composite structures for aerospace applications and the application of important concepts in this field. The course comprises the following:

Semi-monocoque structures introduces the principles involved in semi-monocoque structures and the methods of their analysis and includes: stressed-skin structures; bending; torsion and shear in semi-monocoque structures; instability and post-buckling behaviour of stiffened plate structures; and semi-tension fields; load introduction; cut outs; and loads on fuselage frames and wing ribs.

The course assumes familiarity with the fundamental principles in mechanics, strength of materials and material properties.

- 1) Energy methods of structural analysis including the calculation of loads deflections using complementary energy methods.
- 2) Damage tolerance introduces the principles associated with safe aircraft structures
- 3) Aeroelasticity includes static phenomena including divergence and control reversal; lifting surface flutter and control surface flutter.

Course Code: MECN5011A

Course Description: Compressible Flow and Propulsion

NQF Credits: 20

NQF Level: 8

This course consists of a selection of primary topics on compressible gas dynamics and fluid dynamics. Candidates are introduced to the analysis of aircraft propulsion systems and of one-dimensional compressible flow fields including friction and thermal effects as well as some elements of two-dimensional gas dynamics. The course also includes an introduction to the application of modern computational fluid dynamics (CFD) through the use of a common commercial CFD package. The course consists of:

- 1) Compressible flow: Flow with area change; friction and heat transfer; normal shock waves; oblique shock waves; Prandtl-Meyer expansion; typical flow geometries (pipe flow; engine intakes; aerofoils); nozzle design; wave reflections; method of characteristics; unsteady flows.
- 2) Propulsion systems: Basics of jet and non-jet propulsion engines; thermodynamics and mechanics of propulsion engines and their components.
- 3) Computational fluid dynamics: Fundamental theory and simplifications; discretisation; grid generation; numerical schemes; incompressible flow; supersonic flow; introduction to the use of a commercial CFD package and the general philosophy of CFD modelling.

Course Code: MECN5012A

Course Description: Mechanics of Solids

NQF Credits: 20

NQF Level: 8

This course focuses on the following topics:

Solid Mechanics: Torsion of solid noncircular shafts and thin-walled tubes; inelastic torsion of circular shafts; unsymmetric bending; shear stresses in beams; failure theories; deflection of beams; buckling of columns; energy methods; virtual work.

Mechanics of Composite Materials: Materials; Manufacturing methods; Micromechanics; Macromechanics of a lamina; Failure criteria; Design of composite structures. Finite Element Analysis (FEA): Typical Fields of Application. Introduction to FEA. Typical Steps of a FE Analysis. Finite Elements: e.g. Bars; Beams; Shells and Solids. Generation of Element Stiffness Matrix; Assembly of Global Stiffness Matrix; Imposition of Boundary Conditions; Solving System of Equations; Calculation of Reaction Forces; Stresses and Strains. Finite Element Formulation for Elastodynamic Problems; Principle of Virtual Work. Numerical Integration Method; Gauss Quadrature; Isoparametric Elements; Jacobian. Modelling of Two and Three Dimensional Problems in Linear Structural and Thermal Analyses.

Principle of Virtual Work. Numerical Integration Method; Gauss Quadrature; Isoparametric Elements; Jacobian. Modelling of Two and Three Dimensional Problems in Linear Structural and Thermal Analyses.

Course Code: MECN5013A

Course Description: Thermal System

NQF Credits: 20

NQF Level: 8

This course focuses on the following topics:

Thermodynamics: Vapour power systems; Air standard cycles; Gas turbine cycles;
Refrigeration and heat pump systems; Non-reacting gas mixtures and psychrometrics; Internal combustion engines.

Heat transfer: steady state and transient conduction; Forced and natural convection; Thermal radiation. Extended surfaces in various thermal systems; Boiling; evaporation and condensation; Heat exchangers.

Course Code: MECN5014A

Course Description: Fluid Dynamics

NQF Credits: 20

NQF Level: 8

This course consists of a selection of primary topics on compressible gas dynamics and fluid dynamics. Students are introduced to the analysis of turbomachines in engineering applications as well as to the analysis of one-dimensional compressible flow fields including friction and thermal effects. The course also includes analysis of laminar and turbulent boundary layers and an introduction to the application of modern computational fluid dynamics (CFD) through the use of a common commercial CFD package. The course consists:

Fluid machinery: Centrifugal and axial flow machines; pipe-machine system characteristics; characteristics and behaviour of centrifugal pumps; water hammer.

Compressible flow: One-dimensional flow with area change; friction and heat transfer; normal shock waves; nozzle performance; introduction to unsteady flow.

Computational fluid dynamics: Fundamental theory and simplifications; discretisation; grid generation; numerical schemes; incompressible flow; supersonic flow; introduction to the use of a commercial CFD package and the general philosophy of CFD modelling.

Laminar boundary layer flow: boundary layer (Prandtl) equations; Von Karman's momentum integral equation;

Thwaites/Walz method for flows with pressure gradients.

Turbulent flows: Fundamental theory; common models and limitations; turbulent boundary layers.

Course Code: MECN5015A

Course Description: Mechatronics

NQF Credits: 20

NQF Level: 8

This course focuses on the following topics:

Introduction to mechatronics: Background and philosophy of Mechatronics; Synergistic use of pneumatic; hydraulic; mechanical; electrical; and electronic actuation in mechatronic system applications. Measurement systems; theory and analysis.

Basic Control Concepts and Model Types: dynamic system performance; mathematical models of electrical; hydraulic and mechanical systems; linearisation and its limitations; introduction to the advantages of feedback.

Systems Response: free and forced responses of first- and second-order systems; step; ramp and sinusoidal response patterns.

Transfer Functions and Frequency Response Methods: Laplace transform and their application to solving linear; constant-coefficient differential equations; transfer functions; frequency response and Bode plots.

Feedback Control System Characteristics: open- and closed-loop control systems; sensitivity to parameter variations; transient response of controlled systems; disturbance signals in control systems.

System Performance Specifications: types of performance specifications (time- and frequency-domain).

Stability of Linear Feedback Systems: types of stability; mathematical conditions of stability; gain and phase margins; root locus plots.

Dynamic Responses of Systems with Control Elements: concepts of feedback control; general control system structure; control laws of on-off; proportional; integral and derivative control; design of closed-loop; feedback controllers; feed-forward and cascade schemes.

Course Code: MECN5017A**Course Description: Lean Management****NQF Credits: 20****NQF Level: 8**

This course consists of the application of lean methods in the management of operations and services. The course covers five lean principles including, waste elimination, lean production systems, value stream mapping, managing extended supply chains, the lean enterprise, tools and terminology for fast, flexible flow, lean and six sigma, introduction to lean service, and the introduction to lean new product developments. This course develops competence in the application of lean principles, tools and techniques in order to manage systems efficiently.

Course Code: MECN5016A**Course Description: Accounting and Financial Statements in Engineering****NQF Credits: 20****NQF Level: 8**

This course covers the application of accounting and financial statements in engineering environments. The course also covers various financial statements, including the statement of income, statement of financial position and statement of cash flows. This course develops competence in using accounting and financial statements in engineering management as carried out in the context of engineering operations and service systems.

Course Code: MECN7000A**Course Description: Operational Research Methods****NQF Credits: 20****NQF Level: 9**

The course provides candidates with the competencies needed to analyse; model and optimise an organisation's processes. It aims to give candidates an understanding of how to select and apply mathematical modelling and data management techniques in different business contexts and to contribute to the optimisation of the performance of organisations. Various business process modelling and optimisation methods are presented. These include an introduction to linear programming; transportation and network problems; integer programming; stochastic processes and related software. Problems are formulated to illustrate theory; practice and OR management.

Course Code: MECN7001A**Course Description: Reliability Engineering****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: Basic concepts. Failure probability density functions. Component reliability. Reliability of systems. Methods for determining reliability of systems. Active and standby redundancy. Testing for reliability. Sampling techniques.

Course Code: MECN7005A**Course Description: Engineering Economics****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

- 1) Introduction: comparative economic systems; the market economy: demand; supply and equilibrium price; elasticity; measurement; economies of scale and learning curves;
- 2) Theories of the firm: Neo-classical economics – price takers and seekers; objectives of organisations; New Institutional Economics;
- 3) Functions in firms: economic theory for marketing and finance in engineering organisations. Directions for research in Production and Operations management.

Course Code: MECN7006A**Course Description: Production and Operations Management****NQF Credits: 20****NQF Level: 9**

This course exposes the candidate to the broad scope of production and operations management; covering from high level strategic management philosophies down to day to day management tools. However the emphasis will be on tools that will help the candidate best manage at their level within the company. Emphasis will also be placed on the student's role in POMS in the workplace. The course structure will be made up by lectures and case studies (these will form an important part of the teaching process).

Course Code: MECN7007A**Course Description: Elements of Commercial and Industrial Law****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

Introduction to law; General principles of contract; Purchase and sale; Letting and hiring of work and services; Labour relations legislation; Agency and suretyships; Business entities; Principles of intellectual property rights (Copyright; Patents; Trademarks); Alternative dispute resolution; Liability and damages.

Course Code: MECN7008A**Course Description: Financial Management****NQF Credits: 20****NQF Level: 9**

The course focuses on capital budgeting and financial decision making in the corporate environment. Studied are: methods of evaluating alternative investment proposals (e.g. payback; NPV and IRR); analysis of risk using decision trees and other methods; cash flows including inflation and tax effects; capital structure and working capital analysis. Special topics are treated through case study analysis and syndicate research.

Course Code: MECN7009A**Course Description: Principles of Management****NQF Credits: 20****NQF Level: 9**

Management can be defined as "Achieving Results Through People". The course focuses on the functions of management. Planning; Organising; Leading; Controlling. Case study evaluations are used to delineate the function of management in each area. The tools and concepts of negotiation are also covered.

Course Code: MECN7010A**Course Description: Human Resource Management****NQF Credits: 20****NQF Level: 9**

Human resources can best be managed as a partnership between line managers and human resource practitioners. This course optimises this partnership by equipping prospective managers with the knowledge and skill to meaningfully contribute to HR Planning; Recruitment; Remuneration; Performance Management; Training and Industrial Relations. The course takes a strategic view of environmental variables that may necessitate change in HR management practices. Current issues that may have to be accommodated in the management strategy are discussed and analysed.

Course Code: MECN7011A**Course Description: Accounting and Financial Statements****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

The nature and role of accounting in business. The elements of double-entry bookkeeping. The balance sheet; income statement and statement of changes in equity. Accounting for close corporations and companies. The cash flow statement. Analysis of financial statements for management and investment purposes.

Course Code: MECN7013A**Course Description: Principles of Air Conditioning****NQF Credits: 20****NQF Level: 9**

This course equips candidates with a fundamental scientific understanding of the most important issues concerning the design of air conditioning systems for buildings. The course consists of the following components:

Psychrometry and psychrometric processes; physiological principles of thermal interchanges between man and his/her environment; comfort and health; cooling and heat load calculations in buildings; fan and duct systems; basic air conditioning systems focusing on: fundamentals; application and performance.

Course Code: MECN7014A**Course Description: Principles of Refrigeration****NQF Credits: 20****NQF Level: 9**

This course equips candidates with a fundamental scientific understanding of refrigeration processes and equipment; as used in industrial; air conditioning and mining applications. The course covers the following:

Compression refrigeration cycles; multipressure systems; refrigeration system components; refrigerants; absorption and other refrigeration processes; heat pumps.

Course Code: MECN7016A**Course Description: Quality Management****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

Concepts and perspectives on quality. How to analyse and improve a work process. Quality of design; conformance; maintenance and service. Various tools for improvement. Process capability and process control methods. Using cost data as a basis for improvement. The measurement of customer response and the achievement of customer-focus. Quality management systems: ISO 9000; Total Quality Management; Benchmarking; The Baldrige System. Philosophies of quality management: e.g. Deming; Juran; Shingo and the process of Quality Function Deployment. Case studies and site visits.

Course Code: MECN7017A**Course Description: Value Engineering and Analysis****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

History and application. Value systems – group dynamics. Planning of workshops. Information validation and objective setting. Definition and priority of functional requirements. Innovative and lateral thinking techniques. Function – cost relationship. Evaluation and decision analysis. Project reporting and implementation. Financial justification. Workshop application study.

Course Code: MECN7019A**Course Description: Internal Combustion Engine Analysis****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

Engine types and their operation. Engine designs and their operating parameters. Thermochemistry of fuel-air mixtures. Properties of working fluids. Ideal models of engine cycles.

Course Code: MECN7023A**Course Description: Management of Technology****NQF Credits: 20****NQF Level: 9**

This course focuses on managing innovation and technological change. Strategic and tactical issues covering the process; technology transfer; research and development infrastructure; co-operation in research and development; technology and economic analysis; technology and human issues; commercialisation including intellectual property rights.

Course Code: MECN7024A

Course Description: Maintenance Engineering

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics:

Maintenance objectives; RAM – Reliability; Availability and Maintainability; Maintenance organisation; Maintenance staffing and training; Maintenance planning and schedule; The work order system; Maintenance control – performance measures for internal control and benchmarking for comparisons with other companies and other industries; Maintenance inventory; Maintenance audits; Specific techniques: critical path analysis for the project management of outages; RCM for maintenance optimisation; condition monitoring; Computerised maintenance management systems (CMMSs); Maintenance contracts and penalty and reward systems; Total productive maintenance (TPM).

Course Code: MECN7026A

Course Description: Finite Element Methods

NQF Credits: 20

NQF Level: 9

The course introduces the concept for developing 1D and 2D linear finite elements including the formulation for developing the strain and stiffness matrices. It also further aims at giving detailed analysis for solving the differential equations using Gauss Integration. Finally few practical examples will be solved using the commercial FEA packages.

Course Code: MECN7027A

Course Description: Discrete Event Simulation

NQF Credits: 20

NQF Level: 9

The course introduces basic probability theory and then focuses on its application to probabilistic analysis and modelling of stochastic systems. Topics include: Probability distributions; Chi Squared testing; Markov chains; Monte Carlo simulation; Elementary queuing theory; Discrete event simulation modelling.

Course Code: MECN7117A

Course Description: Lean Operations

NQF Credits: 20

NQF Level: 9

This course introduces the principles of lean operations in manufacturing and service industries. Five lean principles, waste elimination, lean production systems, value stream mapping, managing extended supply chains, the lean enterprise, tools and terminology for fast flexible flow. The course also covers lean and six sigma, introduction to lean in service and the introduction to lean new product introduction.

Course Code: MECN7029A

Course Description: Mathematical Topics for Engineering Management

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics: Revision of linear algebra: Linear spaces; bases and dimension; matrices; eigenvalues and eigenvectors.

A selection from the following applications:

Leontief input-output analysis: The representation by linear equations of the Leontief model for an economy and the workability of this model.

Von Neuman balanced growth model: Relative stability of the balanced growth path; the minimax theorem on zero-sum two-person games; Von Neuman growth model.

Production processes in activity analysis: Linear programming problems; the differential calculus approach to linear programming.

Graph theory: Elementary concepts as required for a selection from the following topics.

Eulerian graphs: Applications to transportation problems.

Hamilton graphs: Related to transportation problems.

Connection problems: An introduction to trees; trees and probability; the theorem of Bayes as applied to connection problems.

Diagraphs: A traffic system problem.

Planar graphs: An introduction to planar graphs using the three house and three utilities problem.

Course Code: MECN7032A

Course Description: Management Accounting

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics:

Cost classification; the allocation of direct and indirect cost (traditional versus ABC); absorption versus variable costing; decision-making including risk and uncertainty; modelling and relevant costing; planning and control including budgeting; standard costing and performance evaluation; design of costing systems.

Course Code: MECN7033A

Course Description: Automotive Engineering

NQF Credits: 20

NQF Level: 9

The course relates to the automotive industry with an emphasis on engines. Topics may include: lean manufacturing in automotive manufacture; mechatronic systems; engine testing and control; instrumentation and data acquisition; overall engine performance; suspension design.

Course Code: MECN7034A

Course Description: Bulk Solids Storage and Handling

NQF Credits: 20

NQF Level: 9

This course provides candidates with a comprehensive introduction to the subject of bulk materials handling and storage. It demonstrates the importance of flow property measurements and the application of this information to the design of storage bins and feeding and handling equipment. The following topics are studied in the course:

Characterisation of bulk solids; basic properties of particulates; property variation of bulk solids; basic concepts in mass; funnel and expanded flow bin design; application of flow properties to the determination of bin wall loads and feeder loads; interfacing of feeders with storage vessels; determination of draw-down characteristics and live capacity of gravity-reclaim stockpiles; design of screw feeders and an introduction to mechanical conveying.

Course Code: MECN7035A

Course Description: Belt Conveying of Bulk Solids

NQF Credits: 20

NQF Level: 9

This course provides candidates with a comprehensive overview of the subject of belt conveying. The course presents the fundamental concepts related to the static and dynamic design of belt conveyor systems. It demonstrates the importance of belt and bulk solid interactions and presents an overview of transfer chute design and maintenance strategies.

The subject matter of this course will include: An overview of open and closed belt conveying systems; static design principles; design of horizontal and vertical curves; conveyor belt manufacturing considerations; dynamic analysis; high speed belt conveyor design considerations; bulk solid and conveyor belt interactions; transfer chute design; belt conveyor maintenance strategies.

Course Code: MECN7051A**Course Description: Business to Business Marketing****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

Introduction to the principles of marketing; the marketing variables; market segmentation; differentiation and positioning. Business to business product offering. Buyer-seller relationships. Business to Business exchanges. The role of relationship marketing in business marketing arena. Share of mind and share of wallet. The business marketing communication mix. The role of internet and email marketing in communicating value in Business Marketing. Value driven pricing determination. Personal selling and sales management. The development of a marketing plan for a business product. Case studies and oral presentation.

Course Code: MECN7053A**Course Description: Systems Engineering Management****NQF Credits: 20****NQF Level: 9**

This course introduces risk management; configuration management; technical performance management; concurrent engineering management and speciality management. For all of these; the purpose and what needs to be done and how it can be approached are presented.

Course Code: MECN7054A**Course Description: Systems Engineering: Soft Systems Methodologies****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

Introduction to systems theory and the systems framework. Methodologies for problem solving and systems analysis. Applications areas. Selected topics on systems management. Case studies.

Course Code: MECN7055A**Course Description: Requirements Analysis in Systems Engineering****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

Starting with the purpose of RA; the requirements process and requirements types need to be presented. An area which needs some attention is elicitation techniques; using scenarios for example; and sources of requirements. Considerable effort is spent on techniques for RA; including the purpose and applicability of each technique. These are essential to defining the problem before any specifications are written. Candidates will need to develop the discipline of separating the problem from the solution. The characteristics of good requirements (requirements quality) should be addressed in conjunction with writing specifications. Managing RA ranges from planning a RA effort to creating traceability to stakeholders and operational concepts. A healthy dose of emphasis on iteration is required. Product scoping may be very useful in the context of RA to create a common vision; draw a boundary as to what is or is not a requirement and a tool for gauging the size of the effort.

Course Code: MECN7056A**Course Description: Systems Engineering: Architecture****NQF Credits: 20****NQF Level: 9**

Architecture is not a mature field with a widely accepted underlying theory; thus; a number of approaches to architecture are presented. This depends on whether these are software; or hardware and the specific type of hardware systems e.g. largely signal processing; like radar. Key to architecture is creativity; dealt with in concept generation. Alternatives need to be generated both at the system level and at function level. Concept generation is supported by behaviour analysis (part of which is functional analysis). The course covers both the development of structural (physical) and behavioural aspects of architecting. Concepts relating to the development of alternatives; the evaluation of these and the selection of candidate architectures; the issue of traceability from requirements; functions and allocation to system elements; the concept of technical budgeting; supported by modelling and simulation and technology as the basis of any solution and the concept of technology maturity are presented.

Course Code: MECN7057A**Course Description: Enterprise Engineering****NQF Credits: 20****NQF Level: 20**

The course explores how enterprises structure themselves and how technology is used as an enabler to ensure the enterprise achieves competitive advantages. Topics cover computer integrated management encompassing the technological hierarchy from non-assembled products (field devices); simple assembled products (robotics); closed systems (management; administration) and open systems (ERP management; world wide web); different technological hierarchies are linked from a technological and enterprise wide level; how technologies converge and how this convergence of technology may lead to better enterprise collaboration.

Course Code: MECN7058A**Course Description: Systems Engineering: Hard Systems Methodologies****NQF Credits: 20****NQF Level: 9**

The course introduces the basic concepts and motivation for applying Systems Engineering principles. Basic concepts are be introduced; for example; “What is a system?”; “What is a system lifecycle?” and “What is systems thinking?”. Hard Systems principles are covered; for example: Capture and understand the problem before committing to the solution. Modelling notations for SE are introduced that support understanding; reasoning and communication about the system. An implicit architecture framework underlying the modelling notation is presented.

Course Code: MECN7059A**Course Description: Supply Chain Management****NQF Credits: 20****NQF Level: 9**

The course gives an in-depth coverage of supply chain management and logistics in the context of contemporary operations; taking into account the major competitive drivers of efficiency and responsiveness and the solutions enabled by new technologies. The module addresses the scope; impact and importance of SC and Logistics management and the major decisions that need to be made in today's world of global supply and global markets.

Course Code: MECN7060A**Course Description: Operations Management for Mining Systems****NQF Credits: 20****NQF Level: 9**

This course explores operations management in the mining context from a systems perspective; considering the context and challenges of this unique environment. The purpose is to provide candidates with an overview of key terminology; an introduction to basic techniques and examples and cases of how these can be applied in the mining context. The course aims to develop the critical thinking and application skills of candidates. The syllabus includes: current state analysis; value chain mapping; process analysis; constraint identification; root cause analysis; metrics and measures; problem solving methodologies; principles of systems engineering; organisational behaviour and soft systems issues.

Course Code: MECN7061A**Course Description: Extended Finite Element Methods and Meshfree Methods****NQF Credits: 20****NQF Level: 9**

The course develops an extended finite element (XFEM) analysis for understanding the computational fracture mechanics that involves initiation and propagation of cracks. The course also focuses on introducing the meshfree methods; concept of weighting functions and meshfree approximations. Further it addresses the coupling procedure for meshfree methods with FEM. Lastly; the concept of enrichment linked with the development of XFEM; Level sets and implementation will be addressed.

Course Code: MECN7062A**Course Description: Systems Engineering: An Overview****NQF Credits: 20****NQF Level: 9**

The course provides students with a global understanding of Systems Engineering history; concepts and role in everyday business practice. The course examines the concepts of Soft and Hard Systems Methodologies; and, through case studies; how a Systems Approach can be used to integrate a number of interrelated disciplines such as: Project management; Lean concepts; Information technology and Innovation.

Course Code: MECN7063A**Course Description: Systems Engineering – Modelling and Simulation: Principles and Approaches****NQF Credits: 20****NQF Level: 9**

The course introduces the basic concepts and motivation for the use of M&S as part of Systems Engineering. Basic concepts are to be introduced; for example; “What is a framework”; “What is a model and what is meant by simulation?” The important question of model boundaries will be addressed. Cascading through modelling approaches to develop system and sub-system concepts will be introduced and the idea of analysis-synthesis loops will be covered. The module will build on the notations introduced in the introduction to Systems Engineering that support understanding; reasoning and communication about the system

Course Code: MECN7064A**Course Description: Systems Engineering: Integration; Verification and Validation****NQF Credits: 20****NQF Level: 9**

The course introduces the concepts of integration; verification and validation. The importance of interface design and management in integration is addressed. Design verification; design margin verification (qualification); reliability verification; software quality verification and system certification is all included under the verification concepts. Validation addresses techniques in ensuring that the users are satisfied and that the system is fit for purpose.

Course Code: MECN7065A**Course Description: Service Engineering****NQF Credits: 20****NQF Level: 9**

The course gives an in-depth coverage of Service engineering in the context of contemporary operations; taking into account the major competitive drivers of efficiency and responsiveness and the solutions enabled by new technologies. The module addresses the scope; impact and importance of service engineering and the major decisions that need to be made in today's world of a globally connected service based economy. In this context; the field of service engineering enables us to innovate; design; and manage simple and complex service operations and processes of the intelligent service-based economy.

Course Code: MECN7066A**Course Description: Research Methods in Engineering****NQF Credits: 10****NQF Level: 9**

The course prepares candidates for the final submission of his/her research proposal. The course will cover research problem formulation; compiling; organising and critically reviewing literature; dividing problems into sub problems; identifying required data; variables and controls and data analysis.

The course will also familiarises the candidate with research methods and identification of types of data (qualitative or quantitative); different methods of data collection; and approaches to analysing both qualitative and quantitative data.

Course Code: MECN7067A**Course Description: Financial Modelling for Nuclear Energy Projects****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

- 1) Identifying risks relating to financing power generation projects and the management of such risks;
- 2) Preparing budgets for power generation projects;
- 3) Building a business case for alternate power generation projects with particular focus on Nuclear projects; and
- 4) Matching resource requirements to budgets for project life cycles.

Course Code: MECN7068A**Course Description: Leadership of Nuclear Strategy****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

- 1) Concepts of strategic leadership in the development of organisations;
- 2) Project performance and their link to strategic goals;
- 3) Understanding stakeholders and managing their expectations and concerns; including the use of power dynamics in the organisation;
- 4) Managing human resources to achieve strategic objectives;
- 5) Leading and managing a culture of innovation and self-development including creating a learning organisation;
- 6) Lead change initiatives; including those of mergers and acquisitions and management of joint ventures;
- 7) Creating and implementing a safety culture; and
- 8) Strategic management of corporate social responsibility.

Course Code: MECN7069A**Course Description: Regulation and Security of Nuclear Energy Projects****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

- 1) Enhancement of skills for managing safety and licensing and associated regulatory processes in accordance with up-to-date international standards and best practice;
- 2) Provision of up-to-date insight into topical nuclear and radiation safety and licensing issues;
- 3) Provide skills to manage interfaces between regulatory authorities; technical support organisations operator organisations; vendors and other stakeholders in the regulatory and licensing process over the lifetime of facilities and activities;
- 4) Basic elements of nuclear security: Prevention; Transport security; Detection; Response; Information security;
- 5) Planning nuclear security of nuclear/radiological facility: Creating a visible security policy; Conduct; competence; Behaviour and trustworthiness of staff; Clear roles and responsibilities; Physical protection systems; Design basis threat; Physical protection principles; design and evaluation; Response measures and communication; Nuclear material accounting and radioactive material inventory control; Contingency plans and drills; and
- 6) Providing delegates with the essential knowledge of current legislation pertaining to the Nuclear environment.

Course Code: MECN7070A**Course Description: Strategic Management of the Nuclear Energy Project Lifecycle****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics: Conceptualisation of the project; Planning, including funding proposal; Securing funding; Project inception; Testing Commissioning; Operating and maintenance of the project; Decommissioning and/or refurbishment of a project; Rehabilitation including planning; funding; operation and closeout; Strategic roles relating to the management of the lifecycle; Project sponsors; Steering committees and the like.

Course Code: MECN7071A**Course Description: Pipeline Conveying of Bulk Materials****NQF Credits: 20****NQF Level: 9**

This course focuses on the following topics:

- 1) Slurry conveying: Review of pipeline hydraulics and issues relevant to slurry flow; introduction to slurry systems; settling slurries; non-Newtonian slurry flow behaviour; mixed regime slurries; slurry pipeline hydraulics; applications and examples.
- 2) Pneumatic conveying: Systems and components; gas-solid flows; system design; system operation

Course Code: MECN7094A**Course Description: The Air Transportation System****NQF Credits: 20****NQF Level: 9**

The course reviews air transportation as part of a global; multimodal transportation system; evolution of the technological; social; environmental; and political aspects of this system since its inception at the beginning of the previous century. The long-term and short-term effects of economic deregulation; energy shortages; governmental restraints; national and international issues; and international terrorism are examined. Passenger and cargo transportation; as well as military and private aircraft modes; are studied in relation to ever-changing transportation requirements.

Course Code: MECN7095A**Course Description: Human Factors in the Aviation/Aerospace Industry****NQF Credits: 20****NQF Level: 9**

This course is an overview of the importance of the human role in all aspects of the aviation and aerospace industries. Emphasis is on issues; problems; and solutions of unsafe acts; attitudes; errors; and deliberate actions attributed to human behaviour and the roles supervisors and management personnel play in these actions. Students examine the human limitations in the light of human engineering; human reliability; stress; medical standards; drug abuse; and human physiology. Discussions include human behaviour as it relates to the aviator's adaptation to the flight environment; as well as the entire aviation/aerospace industry's role in meeting the aviator's unique needs.

Course Code: MECN7096A**Course Description: Advanced Aerodynamics****NQF Credits: 20****NQF Level: 9**

In this course; candidates will examine current flight applications and problems. Specifically; this includes transonic; supersonic; and hypersonic aerodynamics; principles of aircraft stability and control; and operational strength considerations. Emphasis is placed on the applications of the rapidly changing technological innovations in aerodynamics and the solutions to the problems created by these advances.

Course Code: MECN7097A**Course Description: Earth Observation and Remote Sensing****NQF Credits: 20****NQF Level: 9**

This course reviews U.S. and International solar system exploration programs and relates them to the current and proposed Earth-research projects. Examination of these research programs will be structured towards defining problems related to environmental changes and resource exploration. Formatted research data from Earth-resource satellites and EOS sources will be used for demonstrating specific research techniques; exploration methods; and economic and social elements of exploration.

Course Code: MECN7098A

Course Description: Aviation/Aerospace Simulation Systems

NQF Credits: 20

NQF Level: 9

The course focuses on a comprehensive examination of simulation in modern aviation/aerospace that includes history; state-of-the-art; and current research and development. Discussions focus on the extent and impact of simulator application throughout the industry and the effects on training costs and safety. Topics range from basic design principles to flight crew training for initial qualification; continuation and currency purposes. The course emphasises implementation of training that is transferable from simulated to real world environments. Systems simulators to the simulation models used in management; flight operations; scheduling; or air traffic control; are examined in detail.

Course Code: MECN7099A

Course Description: Applications in Crew Resource Management

NQF Credits: 20

NQF Level: 9

In this course examines the common concepts of crew resource management (CRM) as developed by major air carriers and explore the theoretical basis of such training. Topics such as supervision of crewmembers; counselling; manner and style; accountability; and role management will be studied. Each candidate has the opportunity to become knowledgeable in a specific area of CRM by assisting in the development of a CRM research document as part of the course. Additionally; each candidate uses simulators and computer-based instruction to supplement academic instruction.

Course Code: MECN7100A

Course Description: Unmanned Aerospace Systems

NQF Credits: 20

NQF Level: 9

This course offers a conceptual approach to overall system design of unmanned aircraft and spacecraft systems; including remotely operated and autonomous unmanned aerial systems (UAS) and unmanned space systems. The course will include the concepts of communication systems; payload systems; control stations and related systems; vehicle specific systems; and support systems. The requirements for system architecture development and conceptual level assessment of major system elements will be examined as they relate to use in industry. The major system elements will be evaluated from a systems engineering perspective to include consideration for cost and weight estimation; basic aircraft performance; safety and reliability; lifecycle topics; vehicle subsystems; and system integration.

Course Code: MECN7101A

Course Description: Applications in Space: Commerce Defence and Exploration

NQF Credits: 20

NQF Level: 9

This course focuses on the following topics:

The scientific; military; and commercial interests in international and domestic space programs are examined throughout the history of space flight. The needs of commercial space endeavours and methods of expanding space technology into manufacturing are contrasted to the importance of scientific exploration; and the requirements of military space operations. The justification; development; and costs of scientific exploration programs; defence-related projects; and commercial endeavours are used to study the evolution of space missions and the development of future programs.

Course Code: MECN7102A

Course Description: Advanced Rotorcraft Operations

NQF Credits: 20

NQF Level: 9

The course introduces the complexities of rotary wing flight systems and the advancements made to overcome them. The unique problems facing an organisation involved in rotorcraft operations are studied from the initial inception of a program to the government rules and regulations; environmental and noise considerations; special landing and take-off facilities; flight and maintenance ratings; and techniques of control. Special consideration is given to the unique problems and issues facing such rotorcraft operations as police; medical evacuation; forestry service; off-shore; and corporate aviation.

Course Code: MECN7103A

Course Description: Aircraft and Space Craft Development

NQF Credits: 20

NQF Level: 9

This course is an overview of aircraft and spacecraft development. Included are vehicle mission; the requirements directed by economics; the military and defence considerations; and the research and developmental processes needed to meet the vehicle requirements. Aviation and aerospace manufacturing organisations and techniques are addressed to include planning; scheduling; production; procurement; supply and distribution systems. The course studies aviation and aerospace maintenance systems; from the built-in test equipment to the latest product support activities.

Course Code: MECN7104A

Course Description: Aerospace Accident Investigation and Analysis

NQF Credits: 20

NQF Level: 9

This course covers all aspects of the aircraft accident investigation process starting with preparation for investigation through report writing. Particular emphasis is placed on the study of human factors connected with flight and support crew activities in aviation operations. The course provides students with knowledge of the process of investigating accidents and incidents in an aviation organisation. A critical analysis of selected aircraft accidents and an evaluation of casual factors are covered.

Course Code: MECN7105A

Course Description: Airport Safety and Certification

NQF Credits: 20

NQF Level: 9

This course reviews and analyses of all local and international regulations applicable to the safe conduct of airport operations. The requirements for airport certification are covered; as well as airport environmental protection and occupational safety compliance. Day-to-day safe operations are emphasized.

Course Code: MECN7106A

Course Description: Management of Research and Development for the Aerospace Industry

NQF Credits: 20

NQF Level: 9

The types and sources of aviation/aerospace research and development are analysed; with a focus on the structure and interrelationship of the industry; educational institutions; and other organisations. Sources and methods of funding; specification determination; the relationship of research and development to procurement and production; and the regulatory factors affecting progress from the initial development to production of the aircraft and components are examined. Concepts of motivation and management as applied to research scientists and engineers will be studied as well as procedures for promoting optimum creativity concurrently with efficient operations.

Course Code: MECN7107A

Course Description: Human Factors in Unmanned Aerospace Systems

NQF Credits: 20

NQF Level: 9

This course is an overview of the importance of major human factors issues associated with unmanned systems; including remotely operated and autonomous unmanned systems (US) and unmanned space systems operations across a variety of platforms employed in both commercial and military operations. Emphasis will be placed on the differences and commonalities between occupied and unoccupied systems; with a focus on the human factor issues encountered by individual unmanned operators

(pilots and sensor operators) as well as UAS teams. Students will become familiar with human factor issues surrounding unmanned launch; recovery; long duration operations; fatigue; human performance; Ground Control Station (GCS) design; use of automation; Situation Awareness (SA); Crew Resource Management (CRM); integration into the National Airspace System (NAS); attitudes and perspectives of both government agencies and public entities; use of technology to compensate for no-pilot-on-board; and regulatory issues and solutions. Discussions of human capabilities and limitations as it relates to safe and effective operation of unmanned aircraft and space systems in a variety of commercial and military operations will be included.

Course Code: MECN7108A

Course Description: Lean Management of Healthcare Systems

NQF Credits: 20

NQF Level: 9

This course explores operations management in healthcare from a systems perspective; considering the context and challenges of this unique environment. The purpose is to provide candidates with an overview of key terminology; an introduction to basic techniques and examples and cases of how these can be applied in a healthcare context. The course aims to develop the critical thinking and application skills of candidates. The syllabus includes: Lean philosophy; current state analysis; value stream mapping and process analysis; constraint identification; root cause analysis; metrics and measures; problem solving methodologies and principles of systems engineering and thinking; scheduling and planning for efficient practice; organisational behaviour and soft systems issues.

Course Code: MECN7109A

Course Description: The Mechanics of Heavy Vehicles

NQF Credits: 20

NQF Level: 9

The course provides candidates with the competencies needed for truck design; operation and manufacture. It aims to give candidates an understanding of the swept path; stability; and rollover behaviour of articulated vehicles. The course will focus on how the tyres; suspensions; brakes and steering systems affect the overall performance of the vehicle in terms of vehicle dynamics. The syllabus will cover: Performance-based standards to assess vehicle safety; low-speed swept path; frontal swing; tail swing; rearward amplification; high-speed transient off tracking; dynamic load transfer ratio; yaw-damping coefficient; trackability on a straight path; static rollover threshold; start ability; grade ability A and B; and acceleration capability.

Course Code: MECN7110A

Course Description: Vehicle Dynamics and Automotive Engineering

NQF Credits: 20

NQF Level: 9

The course provides candidates with the basic tools and analysis methods to assess the vehicle dynamics of a vehicle. The course will cover the topics of tyre models; traction and braking; quarter-car analysis; pitch-plane analysis; and roll-plane analysis. The course will cover: how to use handling diagrams to determine the oversteer or understeer characteristics of a vehicle; the effect of load distribution; engine characteristics; gearing and braking torque on acceleration; analysis of body acceleration; working space and dynamic tyre force using a quarter-car model; wheelbase filtering; the ride versus vehicle stability trade-off.

Course Code: MECN7111A

Course Description: Research/Industrial Project

NQF Credits: 45

NQF Level: 9

In this requires candidates to investigate a problem or topic in the general field of engineering which must include: a detailed literature review; data collection, analysis and interpretation; conclusions and commensurate recommendations on the solution to the problem or topic. A comprehensive report demonstrating the candidates' competencies in the investigation, its evaluation and technical reporting must be submitted.

Course Code: MECN7112A**Course Description: Engineering Investigational Methods****NQF Credits: 20****NQF Level: 9**

The course prepares candidates for the application of engineering investigational methods. The course covers investigational problem formulation; compiling; organising and critically reviewing literature; dividing problems into sub-problems; identifying required data; variables and controls and data analysis. Candidates are required to develop and demonstrate competence to apply the engineering investigational methodology in order to design and conduct investigations and/or experiments; and to analyse and interpret the results.

Course Code: MECN7113A**Course Description: Strategic Management in Engineering****NQF Credits: 20****NQF Level: 9**

This course explores the topics essential to the contemporary manager as it focuses initially on the broader business environment and narrows to organisational strategy; implementation of the strategy through operational plans and to leadership which includes management of self; others and teams; performance and communication. Other topics include the management of innovation and change leadership. A common thread running through the programme is the integration of technology in management systems; ethics and creating space for innovation.

Course Code: MECN7114A**Course Description: Operations Strategy****NQF Credits: 20****NQF Level: 9**

This course establishes the basic concepts of strategy within the context of business and how to transition from the business strategy into a manufacturing (operations) strategy. The candidate will be provided with frameworks and tools to be able to align the manufacturing strategy with the business strategy and continually keep the manufacturing strategy aligned with operations and changing markets. This course focuses on both the manufacturing and services industries. By the end of the course the student will have developed a practical understanding of the following concepts and techniques: understanding the key business strategic concepts and schools of strategy; the ability to link business strategies to the required operations by means of manufacturing strategy; appreciate the role of manufacturing strategy in relation with competitiveness with a local and global market; understanding the components of manufacturing strategy and the interdependencies between the components as to be able to develop an manufacturing strategy; integrate services into the manufacturing strategy (servitisation); developing of manufacturing (operations) strategy for services.

Course Code: MECN7116A**Course Description: Embry-Riddle Aeronautical University Coursework in Aeronautical Engineering****NQF Credits: 80****NQF Level: 9**

This course equips the candidate with a broad understanding of air transport and aeronautical engineering. Topics include air transport policy, regulatory environments and certification, airline operations and a spectrum of operational aspects that are essential to understanding the global airline industry. The course also explores technical aspects of aeronautical engineering such as advanced topics in aerodynamics, rotorcraft operations and aeronautical systems simulation.

Course Code: MECN7118A**Course Description: Machine Learning for Engineers****NQF Credits: 20****NQF Level: 9**

The course provides a solid foundation in machine learning techniques both theoretical as well as practical. The course covers an understanding of different supervised and unsupervised machine learning models and includes case studies implementing both supervised and unsupervised learning models and the design of deep learning models.

SCHOOL OF MINING ENGINEERING**Course Code: MINN1995A****Course Description: Mine Technical Visits****NQF Credits: 0****NQF Level: N/A**

The Mine Technical Visits will be undertaken to mines and mining-related facilities as arranged by the School, to be held during the mid-year vacation and will expose students to different mining operations with different commodities and mining methods. These visits will assist students in preparing for the Mine Design exercise.

Course Code: MINN1996A**Course Description: Practical Workshop Training (Mining)****NQF Credits: 0****NQF Level: N/A**

Practical workshop training will take place over a period of a week and will familiarise students with electrical and mechanical maintenance techniques; the installation and wiring of electrical circuits; assembly of pumps; rock drills; scrapers and gearboxes. Basic plating techniques; design and construction of a welded mining structure.

Course Code: MINN1998A**Course Description: Vacation Work I (Mining)****NQF Credits: 0****NQF Level: N/A**

The period of vacation work should be completed during a period of eight consecutive weeks at the end of the third academic year. The vacation work should take place on a mine, approved mining training centre, or approved mining related facility and should be according to the School guidelines for vacation work. The requirements for satisfactory completion of vacation work are the submission of a vacation work certificate confirming that students has completed their work regularly and satisfactorily during the prescribed period and submit a report on the work undertaken during the period of vacation employment.

Course Code: MINN2006A/MINN2007A (PT)**Course Description: Engineering Services for Mining****NQF Credits: 16****NQF Level: 6****(16) (4-0-2)**

This course equips students with an understanding of engineering services that are required to support the mining production process including automation and robotics as applied in mining. The broad topics that are covered include: pumping and pump selection; haul road construction and maintenance; shafts and hoisting; electrical reticulation underground; instrumentation and measurement; robotics and automation.

Course Code: MINN2008A/MINN2009A (PT)**Course Description: Introduction to Underground and Surface Mining Methods****NQF Credits: 16****NQF Level: 6****(16) (6-0-0) (1 term)**

This course develops a basic understanding of the choice of method of extraction applicable to different geological settings. Topics include: access to the orebody; required technical services; underground and surface mining methods (inclusive of both, hard and soft rock, and conventional and mechanised mining methods).

Course Code: MINN2010A/MINN2011A (PT)**Course Description: Computer Applications in Mining****NQF Credits: 8****NQF Level: 6**

(8)(1-0-2) (1 term)

This course augments skills developed in first year to applications relevant for Mining Engineering. Topics covered include an introduction to communication applications such as the internet and electronic mail; an introduction to an appropriate CAD package.

Course Code: MINN2012A/MINN2013A (PT)
--

Course Description: Explosives Engineering

NQF Credits: 10

NQF Level: 6

(10) (4-0-0) (1 term)

This course develops an understanding of the use of explosives to break or fragment in-situ rock including basic blast design calculations. The following broad topics are included: rock drilling for blasting; explosives; rock breaking by blasting; underground blasting; and surface mining blasting.

Course Code: MINN2014A/MINN2015A (PT)
--

Course Description: Mechanical Excavation of Rock
--

NQF Credits: 16

NQF Level: 6

(16) (4-0-2) (1 term)

This course develops an understanding of the mechanised methods of rock excavation. Broad topics covered include powering systems; rock cutting tools and theories; machine design and applications. It also equips students with skills to collect and analyse experimental data from excavation engineering laboratory tests.

Course Code: MINN2016A/MINN2017A (PT)
--

Course Description: Engineering Surveying
--

NQF Credits: 16

NQF Level: 6

(16) (4-0-2) (1 term)

This course introduces students to engineering surveying concepts and equips them with skills to perform engineering surveying calculations. They are introduced to surveying and surveying calculations as well as surveying technologies and software. The course further develops students' ability to work in teams and produce an integrated practical work report.

Course Code: MINN2018A/MINN2019A (PT)
--

Course Description: Digital Technologies and Mine Data Analytics

NQF Credits: 5

NQF Level: 6

(5) (2-0-0) (1 term)

This course introduces the basics of digital technologies that are applied in the mining industry. It considers the way in which data is generated, collected and analysed to make meaningful decisions. Topics include: Introduction to digital technologies used in the mining industry; data collection systems (hardware, software, databases, format); basic descriptive and inferential statistics; basics of data mining; converting data to useful information; business intelligence in the mining industry.

Course Code: MINN2020A/MINN2021A (PT)
--

Course Description: Computer Programming for Mining
--

NQF Credits: 8

NQF Level: 6

(8) (0-0-3) (1 term)

This course takes place after students have undergone a one-week Programming Bootcamp during a preceding study break. It enhances students' basic skills in a relevant engineering programming language.

Course Code: MINN2022A/MINN2023A (PT)**Course Description: Professional Development****NQF Credits: 5****NQF Level: 6****(5) (0-2-0) (1 term)**

This course reinforces a student's oral and written communication by developing research ethics, research skills and ability to write the research reports. Topics include language and communication; technical report writing and oral presentations; introduction to research methods; referencing; plagiarism and copyright.

Course Code: MINN2024A/MINN2025A (PT)**Course Description: Computer Programming Bootcamp (Mining)****NQF Credits: 0****NQF Level: N/A**

This intensive practical computer programming training bootcamp takes place over a period of a one week and equips students with programming basics in a relevant engineering programming language.

Course Code: MINN3015A**Course Description: Mine Transportation, Automation and Robotics****NQF Credits: 13****NQF Level: 7****(13) (4-1-0) (1 term)**

This course enables students to evaluate elements of mine transportation systems including automated transportation systems and the application of robotics to mine transportation. It will explore the following broad themes: underground man riding and material transportation systems; belt conveyors; underground loading and hauling systems; surface loading and hauling systems; automation and robotics equipment ownership and operating cost.

Course Code: MINN3016A**Course Description: Mineral Resources Evaluation****NQF Credits: 16****NQF Level: 7****(16) (4-2-0) (1 term)**

The course enables students to apply the theory and application of statistical and geostatistical evaluation techniques to estimate the quantity and quality of mineral resources. The course further introduces students to Mineral Resources and Mineral Reserves reporting codes such as the SAMREC code. The following broad themes are covered: sampling of mineral deposits; statistical evaluation methods; geostatistical evaluation methods; and geostatistical evaluation applications.

Course Code: MINN3017A**Course Description: Computerised Mine Design****NQF Credits: 10****NQF Level: 7****(10) (4-0-0) (1 term)**

This course enables students to model an orebody from geological data files and create a mine design. The topics are presented under the following main themes:

Introduction to mine design and planning; mine design and planning software packages; geological data files and management; creation of geological databases; geological block modelling and resource estimation geostatistical evaluation packages; mine design and production scheduling; reporting tonnage and grade.

Course Code: MINN3018A**Course Description: Rock Mechanics****NQF Credits: 16****NQF Level: 7**

(16) (4-0-2) (1 term)

This course enables students to integrate theoretical concepts and principles while performing appropriate calculations in rock mechanics. The topics are presented under the following main themes: mechanics of solids; strength and deformation characteristics of rock. The course equips students with skills to collect, organise and analyse experimental data from rock mechanics laboratory tests.

Course Code: MINN3019A

Course Description: Mine Ventilation and Climate Control

NQF Credits: 16

NQF Level: 7

(16) (4-0-2) (1 term)

This course introduces mine ventilation concepts and develops skills to undertake mine ventilation calculations. The course topics are presented under the following broad themes: mine ventilation and deep level mining climate control. The course equips students with skills to collect, organise and interpret experimental data from ventilation and climate control laboratory tests.

Course Code: MINN3020A

Course Description: Water, Energy and the Environment

NQF Credits: 5

NQF Level: 7

(5) (0-2-0) (1 term)

This course enables students to appraise the principles of sustainable development and the related socio-economic environmental factors to be considered in mine design, planning and operation all through to post-closure. The following broad themes are covered: mining and environment; mining and water; mining and energy.

Course Code: MINN3021A

Course Description: Mine Surveying and Geospatial Techniques

NQF Credits: 16

NQF Level: 7

(16) (4-0-2) (1 term)

This course augments prior engineering surveying knowledge by extending the knowledge into a mining environment. The course enables students to integrate mine surveying theory, mathematical and surveying principles. The course also exposes students to current and emerging geospatial techniques such as digital mapping. The course is supplemented by practical work in a simulated underground environment enabling students to perform, process survey observations and produce mine surveying records and plans.

Course Code: MINN3022A

Course Description: Underground Mining Systems

NQF Credits: 18

NQF Level: 7

(18) (7-0-0) (1 term)

This course covers the principles and application of the major underground mining methods for both coal and metalliferous mines, enabling students to assess an orebody and choose a suitable underground mining method. The topics in this course are presented under the following broad categories of conventional and mechanized mining methods: coal mining; massive mining; and tabular hard rock mining.

Course Code: MINN3023A

Course Description: Surface Mining Systems

NQF Credits: 18

NQF Level: 7

(18) (5-0-2) (1 term)

This course covers the principles and application of the major surface mining methods for both coal and metalliferous mines, enabling students to assess an orebody and choose a suitable surface mining method. Topics covered include, design of infrastructure and relevant equipment selection; design parameters; material handling; core risks; and open pit optimisation.

Course Code: MINN4011A**Course Description: Mine Management Principles and Entrepreneurship****NQF Credits: 13****NQF Level: 8****(13) (5-0-0) (1 term)**

This course explores the concepts, principles and regulatory frameworks that are inherent in the management of mining operations and companies. The course covers theories of management and their application in mining business environment. It also introduces students to entrepreneurial acumen. The following broad topics are presented in the course: development of management theory; management functions; organisation theory; leadership; planning; principles of human resources management; labour relations and employment law; social and emotional intelligence; entrepreneurship.

Course Code: MINN4012A**Course Description: Mining Optimisation Techniques and Systems Engineering****NQF Credits: 13****NQF Level: 8****(13) (4-1-0) (1 term)**

This course introduces students to the principles and application through calculations, of the commonly used optimization techniques as applied in mine design and planning. It also enables students to develop a systems engineering perspective of a mining system. The topics are covered under the following broad themes: optimisation and systems engineering.

Course Code: MINN4013A**Course Description: Financial Valuation****NQF Credits: 16****NQF Level: 8****(16) (4-2-0) (1 term)**

This course enables students to rank projects based on their economic value using basic financial valuation techniques that are commonly applied in mining practice. Topics covered include: introduction to value and mine valuation; mine costs; time value of money; capital investment decisions; financing of mining projects; depreciation and replacement decisions; taxation; analysis of financial statements; risk and uncertainty in mining projects; and introduction to mine valuation approaches and valuation reporting codes (e.g. SAMVAL Code).

Course Code: MINN4014A**Course Description: Mine Design****NQF Credits: 36****NQF Level: 8****(36) (5-0-0) (1 term)**

The course requires students to create a mine design in groups which should consider the following broad topics: history, location and description of project; mining policy, rights, licenses, ownership and community issues; evaluation of commodity market; review of geology and stratigraphy with implications for mining; Mineral Resources and Mineral Reserves evaluation; analysis of geotechnical environment, rock engineering requirements and design; review of previous design and mining method selection; mine design criteria; mine layout; blast designs; production scheduling; equipment selection, transportation of ore, people and materials; ventilation requirements and design; mineral processing plant requirements and design; ore-flow accounting; surface infrastructure and load-out facilities; manpower requirements and productivity; environmental impacts, rehabilitation and mine closure; economics of host country's mining taxation; financial valuation; risk analysis and key residual risks. The course augments students' oral and written communication skills.

Course Code: MINN4015A**Course Description: Project Report****NQF Credits: 16****NQF Level: 8**

(16) (0-0-6) (1 term)

This course requires a student to produce a project report on an approved project proposal based on a Vacation Work project undertaken at the end of the third year of study. The course augments students' skills in: technical report writing; literature search; organisation of information; graphical presentation; interpretation of information and formulation of relevant conclusions and recommendations; and oral presentation.

Course Code: MINN4016A

Course Description: Rock Engineering

NQF Credits: 18

NQF Level: 8

(18) (5-2-0) (1 term)

The course equips students with the ability to apply rock engineering design principles within a creative framework in which they may need to make necessary assumptions. The course further augments concepts introduced in Rock Mechanics and aids students in understanding different considerations (both, theoretical and application) made in the rock engineering design process.

Course Code: MINN4017A

Course Description: Health, Safety and Mining Law

NQF Credits: 18

NQF Level: 8

(18) (4-1-2) (1 term)

The course develops skills in environmental aspects related to regulatory, health and safety requirements in the mining industry. The topics covered in this course will be under the following main themes: legal context and OH&S management framework; occupational health; management tools; and safety. Furthermore, the course equips students with skills to collect, organise and interpret experimental data from environmental engineering laboratory tests.

Course Code: MINN7000A

Course Description: Principles of Ventilation

NQF Credits: 20

NQF Level: 9

The course covers: The need to ventilate. Air requirements; a systematic approach. Natural and artificial ventilation of mines and enclosed areas. The flow of fluids and associated properties. Atkinson's equation and friction factors. The thermodynamic approach to ventilation. The design and analysis of simple networks of airway and ducts. Theory of fans. The characteristics; operation and installation of fans. Analysis of ventilation networks; analogue methods; digital methods. Discussion and use of software PC programmes and their application. Auxiliary ventilation systems. Planned recirculation. Introduction to psychrometry. In-Mine heat loads. Haulage insulation and practical applications. Insulation systems for chilled water transport systems. Backfill for heat load reduction. Mine ventilation and refrigeration planning. Refrigeration systems and ice with combinations thereof.

Course Code: MINN7001A

Course Description: Environmental Engineering Topics

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Assessment of environmental impacts on both micro and macro scales. Topics covered include threshold limit values of hazardous substances; radiation in mines and dust; explosive gases and spontaneous combustion; man-made perturbations at the scales of ecosystems; air pollution; the mining and water environment and the land environment. Methods of environmental management; environmental impact assessment; environmental auditing; pollution control and environmental restoration.

Course Code: MINN7005A

Course Description: Mechanical Properties of Rocks and Rock Masses

NQF Credits: 20

NQF Level: 9

The course focuses on: Mechanical nature of rock materials. Deformation; strength and frictional characteristics of intact rock. Time-dependant behaviour; structural features and permeability of intact rock. Geomechanical classifications of rock masses. Deformation and strength characteristics of rock masses. Engineering properties of jointed rock.

Course Code: MINN7006A

Course Description: Geostatistical Methods in Mineral Evaluation

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Traditional distance weighting methods of valuation; statement of basic assumptions; the experimental semi-variogram; interpretation and modelling of semi-variograms; identification of anisotropy and of trend; cross validation methods; ordinary kriging; volume/variance relationship or the regression effect; kriging of areas and volumes; universal kriging; simple kriging and other variations of kriging estimation methods.

Course Code: MINN7007A

Course Description: Statistical Valuation of Ore Reserves

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Definition of ore reserves; classical statistics; normal and lognormal distributions; confidence on mean and variance; grade tonnage calculations; correlations and least squares regression; multi-variable regression; trend surfaces; hypothesis testing for mean; variance and relationship; two-sample tests.

Course Code: MINN7008A

Course Description: Numerical Modelling Techniques in Rock Engineering

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Theoretical framework and assumptions which underlie finite element; boundary element and distinct element modelling techniques. Two-dimensional elastic finite element and boundary element techniques for modelling stresses around mining excavations. Three-dimensional mining simulation analysis. Other techniques for the modelling of rocks and rock masses. Practical numerical modelling project.

Course Code: MINN7009A

Course Description: Trackless Mechanised Mining

NQF Credits: 20

NQF Level: 9

The course covers the following topics: The requirements of a mechanisation culture. Planning requirements for a mechanised operation. Mechanisation in massive mining operations (e.g. block caving); tabular metal mines and coal mines. Latest developments in mine mechanisation. Brief consideration of automation. Number and size of units to achieve the required production in a given situation. Size of excavations in terms of machine geometry; speed and safe clearances. Running surface (roadway) requirements. Engineering selection criteria for units to satisfy safety; health and operating requirements. Operator and artisan issues including selection and training. Infrastructure requirements including engineering workshops; stores; maintenance. Owning and operating costs.

Course Code: MINN7010A

Course Description: Advanced Mechanics of Solids

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Analysis of stresses and strains in three dimensions. Basic equations of compatibility and equilibrium. Constitutive relations and energy of deformation. Stress-strain relations for elastic materials; energy theorems. Methods for solving the basic equations of elasticity. Equations and problems of non-elastic material deformations. Equations describing the behaviour of granular materials.

Course Code: MINN7012A**Course Description: Study and Control of Mining Induced Seismicity****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Properties of vibrations and waves. Vibrations of systems of one degree of freedom. Wave propagation in geological media. Fault rupture process. Size of the seismic event. Frequency – magnitude relation. Focal mechanism. Fault plane solutions. Quantitative models of seismic events. Source radius; stress drop; apparent stress. Intensity of ground motion. Frequency content of ground motion. Measurement of seismic vibrations. Analysis of seismograms.

Course Code: MINN7013A**Course Description: Surface Subsidence due to Underground Mining****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Considerations of subsidence due to the following: coal mining; shallow tabular mining; such as gold; platinum and chrome; massive mining such as block and sub-level caving; abstraction of fluids; e.g. dolomite sinkholes. Prediction of subsidence due to the above types of mining. Characteristics of subsidence movements. Monitoring of subsidence – “conventional” survey methods; GPS methods; airphoto applications; satellite imagery applications; specialist methods including laser and radar systems; geotechnical instrumentation. Management; processing; analysis and presentation of monitoring data. Effects of subsidence – airblasts; disturbance of groundwater regimes and surface hydrology; and surface and structural damage due to subsidence movements. Control of mining-induced subsidence effects – structural considerations; foundation stabilisation; mining restrictions. Environmental effects of subsidence and rehabilitation of subsidence damage. Legal issues relevant to subsidence caused by underground mining.

Course Code: MINN7014A**Course Description: Mineral Economics****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Exhaustible resource scarcity; classification of mineral resources; physical and economic measures of scarcity; scarcity and economic growth. Theory of mineral supply; optimal rate of mineral depletion; intertemporal equity and conservation; intertemporal efficiency.

Course Code: MINN7015A**Course Description: Mineral Policy and Investment****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Elements of mineral policy; government involvement in minerals industry; public policy; international case studies. Economic rent in mining; the distribution of economic rent. Factors affecting international mineral investment; investor goals; host country goals; priority conflicts; costs and benefits of mineral property expropriation. Mineral investment and economic growth. South African mineral policy; formulating a minerals policy.

Course Code: MINN7016A**Course Description: Beneficiation Economics****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Natural resource abundance; national income and economic growth. Potential for mineral-based value-added products and beneficiation industries. Application of Input-Output analysis. Competitiveness and viability of downstream processing. Customer-supplier relationships; the importance of market forces. Location of beneficiation facilities and problems of developing nations.

Course Code: MINN7017A**Course Description: Environmental Economics****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Nature as an amenity; a dump for waste and an exhaustible resource. Resource management and policy. Property rights and The Commons Dilemma. Sustainability; development and economic growth. Economic policy; the market system and environmental taxes. Economic valuation of the environment; the Coase theorem; the Hedonic Price technique; the use of Input-Output analysis. Costs of environmental compliance.

Course Code: MINN7018A**Course Description: Design of Support Systems for Underground Mine Workings****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Pillar load and strength. Design of support pillars. Yield pillars. Pillar reinforcing techniques. Failure criteria applicable to non-production excavations. Principles governing the support of underground excavations. Design of support systems for non-production excavations. Support of production workings. Properties and types of backfill. Backfill as regional and local support.

Course Code: MINN7022A**Course Description: Mechanics and Design of Major Rock Slopes****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Basic mechanics of slope failure in homogenous and jointed media. Acquisition of geological and groundwater data. Analysis of plane; wedge and circular failure. Monitoring of slope stability. Economic and planning considerations for open pits.

Course Code: MINN7023A**Course Description: Coal – Its Quality and Utilisation****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Coal deposition; geological exploration strategy; proximate; ultimate and physical analyses; petrographic analyses; behavioural characteristics; spontaneous combustion; beneficiation; stockpiling and transportation; marketing; waste handling; discard and ash utilisation.

Course Code: MINN7024A**Course Description: Geographical Information Systems****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: GIS as a decision support tool in the Mineral Resources Management environment. GIS concepts and theory; choosing a GIS system; user communication and interface; raster/vector; data structure; format and capture; geocoding; spatial analysis. Case studies and mini project. A specifically developed GIS package will enable hands on experience. Image processing and remote sensing.

Course Code: MINN7025A**Course Description: Mining and the Environment****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Overview of the theory and concepts relevant to mining and its impacts on the biophysical environment. Provide detail on the different mining techniques and processes throughout the mining lifecycle and the impacts of these on water; air quality; biodiversity /ecosystem services and local communities. The requirements of legislation; international guidelines and best practices for managing and mitigating the various impacts; will be addressed. Environmental management from exploration to closure.

Course Code: MINN7026A**Course Description: Economic Geology of Mafic/Ultramafic Igneous Rocks****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Occurrence and exploitation of a wide variety of economically important minerals occurring in association with basic intrusive rocks; with emphasis on the deposits in the Bushveld Complex. Geological setting and distribution of the main ore types in the Bushveld complex. Aspects of ore-body modelling; grade distribution; and mining methods. Examples from southern Africa and elsewhere around the world will be documented to illustrate exploration principles.

Course Code: MINN7027A**Course Description: Geology of Base Metal Deposits****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Overview of the nature and origin of the principal base-metal deposit types in southern Africa. Basic geological characteristics and mode of formation of southern African base-metal deposits. Examples include Aggeneys; Gamsberg; Rosh Pinah; Maranda; Okiep; Tsumeb and Palabora. Porphyry Cu and magmatic Cu-Ni sulphide deposits. The mineralogy of all these deposit types in relation to extractive metallurgical processes. Applied mining geology in the base metal mining environment; exploration methodologies and ore-body modelling. The course involves fieldwork and a project.

Course Code: MINN7028A**Course Description: Economic Geology of South African Coal****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Regional geological setting of southern African coal deposits. Origin of coal; coal type and grade. Features of sedimentary depositional systems and their effects on coal quality. Aspects of applied mining geology and coal mining methods. Coal beneficiation; usage; economics; marketing and environmental aspects. Practical work includes core logging; a coal mine visit; data acquisition; compilation and modelling of a coal ore-body.

Course Code: MINN7029A**Course Description: Applied Geophysics in Mining Exploration****NQF Credits: 20****NQF Level: 9**

The course introduces a range of geophysical methods and techniques being applied in exploration and mining. Topics include an introduction to physio-geological modelling technology in geophysics and the sampling theorem. Gravity; magnetic; seismic; electrical and electromagnetic examples and case studies; with emphasis on contemporary; state-of-the-art geophysics in the minerals industry and on future trends.

Course Code: MINN7030A**Course Description: Economic Geology of Lode Gold Deposits****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Geology of lode-gold deposits in southern Africa with some examples from elsewhere. Overview of the deposits in terms of geological setting; mineralogy; structure and geochemistry. Aspects of applied mining geology with particular emphasis on the practical application of ore-body modelling for mining-related problems and ore-body evaluation. Applied mineralogy and techniques for exploration.

Course Code: MINN7031A**Course Description: Economic Geology on Witwatersrand Mines****NQF Credits: 20****NQF Level: 9**

The course is an overview of the distribution; nature and origin of the principal Witwatersrand conglomerate gold deposits. Basic geological characteristics and mode of formation of Witwatersrand auriferous conglomerates from the various gold fields. Aspects of sedimentology; mineralogy; structure and gold value distribution with respect to ore-body modelling; evaluation and mining. Application of a range of geophysical techniques; surface and underground drilling for exploration. Introduction to gold mining and the environment and to gold and the economy. A project is involved.

Course Code: MINN7033A

Course Description: Practical Application of Simulation Techniques

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Theory and application of simulation techniques applied to the estimation of mineral resources and reserves. Uncertainty and variability in grade estimates and grade distributions can be simulated using various techniques aimed at reducing inherent risk in the available data sets. Simulation techniques such as Monte Carlo; turning bands; LU; sequential; and frequency domains. With computer applications; these will be applied to real examples.

Course Code: MINN7034A

Course Description: Mine Design – Underground Coal Mining

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Mineralogical properties of coal; exploration strategy and analysis; mining systems for coal seams of different shape; attitude and depth; selection of equipment; planning of mine layouts; coal treatment and marketing; financial appraisal; project design.

Course Code: MINN7036A

Course Description: Rock Mass Classification in Rock Engineering

NQF Credits: 20

NQF Level: 9

The course covers the following topics: History of rock mass classification methods. Consideration of Barton's Q System; Bienawski's RMR system; Laubscher's MRMR system; Potvin's stability graph method; and some other approaches. Application of classification methods; their outputs; and their uses for: underground stability evaluation; slope stability evaluation; cave angle estimation; estimation of support requirements; estimation of rock mass deformation and strength parameters. Project involving application of the methods to a problem of the student's choice.

Course Code: MINN7037A

Course Description: Blasting Technology

NQF Credits: 20

NQF Level: 9

The course covers the following topics: History and development of explosives; classification and characterisation of explosives; chemistry and physics of explosives; testing and modelling of explosives; blasting initiation systems; mechanics of explosives and rock interaction; blast design and modelling; computer aided blasting and evaluation techniques for blast outputs; environmental impact of blasting (ground vibration; water pollution; airblasts).

Course Code: MINN7038A

Course Description: Minerals Marketing

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Mineral demand; short- and long-run demand trends; intensity of use and sustainable growth. Mineral supply; economics of by-and co-products; secondary supply and advanced materials. Industrial organisation; competition; monopoly and cartels. Pricing systems and price formation. Mineral price forecasting; supply-demand interaction and commodity analysis. International trade; commodity agreements and government control of mineral industries.

Course Code: MINN7039A**Course Description: Economics of Energy Resources****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Pattern and composition of energy consumption; substitutability of energy raw materials; current sources of supply; potential sources of supply; industrial organisation of energy producers and consumers; government control/regulation of process; markets; environmental considerations; impact of environmental issues on supply; prices and markets of energy.

Course Code: MINN7041A**Course Description: Decision-making for Mining Investments****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Investment decisions in exploration; new mining ventures; projects on existing mines; equipment replacement; and in mining shares; criteria for decisions on viability; mining taxation and lease consideration; effects of different capital structures; mining plans; marketing arrangements; and uncertainty; inflation; cost and price escalations; and changes in exchange rates; cost of capital; hurdle rates; mine amalgamations; risk and sensitivity analyses; share valuations and the capital asset pricing model.

Course Code: MINN7043A**Course Description: Practical Implementation of Geostatistical Ore Evaluation Techniques****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Practical computer-based valuation analysis; including statistical and geostatistical estimation methods. Analysis of sample data - borehole and/or production sampling; value distributions and economic variables; choice of estimation method; identification of trends; spatial continuity and anisotropy; cross validation; various kriging techniques; inverse distance and trend surface fitting. All exercises to be applied to real data sets in practical conditions.

Course Code: MINN7046A**Course Description: Atmospheric Environmental Control and Mining****NQF Credits: 20****NQF Level: 9**

This course introduces contemporary local and global air quality issues; connections between surface mining and large civil engineering projects and air quality; behaviour of airborne particles and the generation of wind blown dust; dust control planning; quantitative emission inventories; control technologies for fugitive dust; measurement principles and available instrumentation; monitoring strategy; management systems for environmental control; and environmental auditing. Case studies; computer based modelling and practical sessions are included.

Course Code: MINN7047A**Course Description: Coal Extraction and Exploitation****NQF Credits: 20****NQF Level: 9**

This course covers the following topics: Underground and open cast mining; equipment; mine planning and design; impact of geological features; reserve resource analysis; mining rights; safety; environmental issues. Methods of handling and transport; truck; conveyor; pipeline and slurries; future transport systems. Stockpiling and storage mechanisms; nature of stored materials including discards; slurries; fines and duff; long-term stockpile protection; environmental impact; organic and inorganic quality changes in stored product with time and weathering; spontaneous combustion; techno-economic impact and utilisation of discards.

Course Code: MINN7048A**Course Description: Coal and the Environment****NQF Credits: 20****NQF Level: 9**

This course covers the following topics: Coal and gas–based environmental issues.

- 1) Land: Impact of coal mining and gas extraction; sealing of underground and open cast mined areas; land rehabilitation; stockpiling; spontaneous combustion.
- 2) Water: Surface and ground water hydrological impacts; physical; geochemical and socio-economic impacts.
- 3) Air: Source and distribution of particulate and gaseous emissions; monitoring; land and plant protection. Health and safety legislations; economic; national and international considerations.

Course Code: MINN7049A

Course Description: Risk Management in Mining

NQF Credits: 20

NQF Level: 9

This course covers the following topics: History of addressing health and safety concerns in the mining industry. Legislation. Safety and health risk in the context of organisational risk. Concepts and theory underpinning risk acceptability; tolerance; transfer and uncertainty. How probability theory is applied in risk management. The risk management process – context; hazard identification; risk assessment (i.e. risk analysis and evaluation); control; communication and review. Risk management tools. Human factors and risk management. Incident investigation and risk management. Local and international case studies.

Course Code: MINN7050A

Course Description: Mineral Resource Management

NQF Credits: 20

NQF Level: 9

This course covers the following topics: Mineral resource management process. Geological ore body models in the strategic; tactical and operational context. Definition of business objectives and translation into a business plan. Skills and competencies for effective mineral resource management. Critical success factors in practical Mineral resource management. Tools of the trade. Models; systems and optimisation. The stages of planning and linkages to feasibility studies.

Course Code: MINN7052A

Course Description: Compliance and Reporting Rules in the Minerals Industry

NQF Credits: 20

NQF Level: 9

The course covers the following topics: The SAMREC Code for reporting of resources and the incorporation of these technical rules into the Listing Rules of the Johannesburg Securities Exchange. The International Accounting Standards Committee's Issues Paper on the Extractive Industries. The course sets the framework for a cross discipline understanding of how to handle these issues particularly in light of the Minerals Development Bill and tightening legal requirements and obligations. It facilitates understanding of the interrelated issues.

Course Code: MINN7053A

Course Description: Economic Definition of Ore

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Development and application of cut-off grades in the minerals industry. Linking of cut-off grades to short and long term planning and optimisation; and to the maximisation of value of minerals projects. Development of dynamic cut-off grades; taking account of orebody depletion and the time value of money. The course has a strong mathematical component; which will be given practical application through software applications on real case studies.

Course Code: MINN7054A

Course Description: Theoretical Simulation Techniques

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Understanding of how to model and quantify orebody evaluation risk; integrate into mine planning and mineral project valuation. Examples at different stages of a mining project. Application of simulation models; (for example; turning bands; sequential gaussian); concepts and applications for the mining industry. Illustration of how geostatistical techniques provide the means to assess orebody grade and tonnage variability in the context of risk assessment and maximum profitability; and in various stages of a mining project.

Course Code: MINN7055A

Course Description: Advanced Mine Valuation

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Principles of Discounted Cashflow analysis as applied to the valuation of mineral projects to an advanced stage. Limitations of these techniques; concepts of option pricing as alternatives. Application of risk analysis and simulation to increase confidence levels; and application of due diligence to mineral project evaluation. The student is required to be able to apply these advanced techniques by way of a case study of a real operation; thus quantifying the benefits of developing and applying these techniques.

Course Code: MINN7056A

Course Description: Analytical Techniques and Quality Assurance

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Establish assaying and analytical techniques for the mineral industry; which allow quality assurance and due diligence. Analytical techniques for various minerals; identification and quantification of biases; establishment of appropriate protocols; elimination of risk; practical use of graphical and statistical techniques to verify; analytical data and identify and isolate problems; quality assurance systems and their implementation; quality control for Mineral Resource Evaluators. The student is required to develop a quality control programme appropriate to his/her sector.

Course Code: MINN7057A

Course Description: Enterprise Risk Analysis in Mining Projects

NQF Credits: 20

NQF Level: 9

In this increasingly important topic in Mineral Resource Management and minerals project evaluation the following aspects are covered: sources; identification of risk in minerals projects; means of dealing with risk; risk adjusted discount rates; technical risk amelioration; risk insurance; simulation methods for risk quantification; risk in DCF analysis; due diligence; market perceptions of risk. Various risk models will be used; and the student will be required to apply these to a real case study of an operation in a remote location.

Course Code: MINN7058A

Course Description: Evaluation of Risk as a Decision-making Criterion

NQF Credits: 20

NQF Level: 9

This course covers the following topics: Specialised risk assessment in the mining industry; since risk is more important to mining than any other industry and investment decisions are critically dependent on seemingly unquantifiable risks. Areas covered include: basic concepts; operational risk in bord and pillar coal mining; reliability of pre-feasibility study of a mining venture; reliability of economic evaluation of a mining prospect; reliability of metal accounting; rock stability related risk in open cast mines; probability of slope failure; risks of injury due to a variety mining activities; reliability of feasibility study of a treatment plant; risks to block caving workings.

Course Code: MINN7061A

Course Description: Sampling Theory and Methods

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Management and quality control of broken ore sampling. Definition of the fundamental sampling error; simple models in the case of complete liberation of the element of interest; binominal and Poisson models; various forms of Gy's formula; practical implementation of Gy's formula and nomograms; critiques and extension of Gy's formula; links with geostatistics through sampling error and nugget effect of variograms. Role and responsibility of Mineral Resource Evaluators in the sampling process; in order to control variance at source. Students will be required to develop a protocol for their own operation; on completion.

Course Code: MINN7062A

Course Description: Probability and Risk in Rock Engineering

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Basic probability and reliability concepts; conditional probability; random variables; finite stochastic processes; fault and event tree diagrams; discrete and continuous probability distributions; central limit theorem; statistical inference. First order second moment; Monte Carlo; fault-event tree analysis; utilisation of geostatistics in rock engineering. Applications: description of rock and rock mass properties; open pit slope stability; underground layout design; and support of underground excavations.

Course Code: MINN7063A

Course Description: Grade Control Techniques and Applications

NQF Credits: 20

NQF Level: 9

This course focuses on the strategy to provide accurate sampling capable of providing reliable data; on thorough statistical evaluations identifying the causes of variability; and on Total Quality Management philosophy will be outlined offering a platform for proactive decisions. Content will include: sampling theory and practice; understanding variability; a strategy to minimise ore grade reconciliation problems. Students will be required to undertake a practically-orientated project.

Course Code: MINN7065A

Course Description: Strategic Planning in Mining

NQF Credits: 20

NQF Level: 9

This course provides a comprehensive understanding and application of planning principles utilised in strategic mine planning. Content may include but will not be limited to: Scenario planning; environmental scanning; strengths; weaknesses; opportunities and threats (SWOT) analyses and other tools for strategic planning; structuring of mining organisations to align them with strategic objectives; aspects of strategic plan implementation and control; the linkage that exists between strategic plans and operation; strategic mine planning; business planning; consolidation; course project assignment.

Course Code: MINN7066A

Course Description: Open Pit Planning and Optimisation

NQF Credits: 20

NQF Level: 9

This course covers the following topics: Latest developments in pit optimisation software. Use of Whittle software - hands on activity. Aspects of pit design and optimisation; including resource estimation; block modelling; pit economics; pit design; pit optimisation; pushback sequence; haul road design; blending and stockpiling strategies.

Course Code: MINN7067A

Course Description: Option Pricing in Mining

NQF Credits 20

NQF Level: 9

The course covers the following topics: Flaws in using discounted cash flow analysis as an introduction to the concept and application of option pricing in mining projects; a technique being used increasingly to deal with the aspect of management flexibility and risk. The course will cover the theory and application of option pricing; using real examples and case studies. The course and a project will allow the students to apply the technique to their own operations.

Course Code: MINN7068A**Course Description: Enterprise and Financial Risk in Mining****NQF Credits: 20****NQF Level: 9**

The course covers the following topics: Theory and quantification of risk covering many aspects of risk (financial; technical; political; geographical); culminating in the hands-on use of the MinVest program. This will be applied to real data sets; so that the student becomes proficient in both the theory of risk and its identification and management; as well as in its incorporation into real cashflows.

Course Code: MINN7069A**Course Description: Strategy; Operations and Risk Management for Minerals Resources Companies****NQF Credits: 20****NQF Level: 9**

This course describes the elements of management required for competitive minerals resources companies. Formulation of strategic plans that enable successful company competition in the global market. Effective operations management systems are addressed. Business risk management plans identify; quantify and simulate risks. Global competitiveness combines strategy; operations and risk management in an iterative process. Relevant theory; a host of case studies; workshops and insight from industry experts in the fields of strategy; operations and risk management.

Course Code: MINN7070A**Course Description: Real Options in Mining Applications****NQF Credits: 20****NQF Level: 9**

The course examines the flaws in using discounted cash flow analysis as an introduction to the concept and application of option pricing in mining projects. This is a technique used increasingly to deal with the aspect of management flexibility and risk. This course will cover theory and application of option pricing; using real mining examples and mining case studies. The course and the project will allow the students in the mining engineering field to apply the technique to their own operations.

Course Code: MINN7071A**Course Description: Planning a Block Cave****NQF Credits: 20****NQF Level: 9**

Block caving is an effective and low cost mining method for massive orebodies. Capital must be spent in advance to install the cave and its extensive infrastructure. This course considers the detailed planning of the cave through the various planning cycles - the conceptual study; geological and geotechnical evaluation of the orebody; a pre-feasibility study; a feasibility study; construction and implementation of the cave and finally production management. Planning tools and the way in which they are used are dealt with.

Course Code: MINN7072A**Course Description: Block Caving Principles****NQF Credits: 20****NQF Level: 9**

This course considers the following: underlying geotechnical and mining principles of block caving; including the hydraulic radius required to initiate caving; prediction of the fragmentation that will result as caving results; the fragmentation that reports to the draw points and the effect of this on the mining layouts; on process and on production; the prediction of stresses that develop in the cave since these have an effect on the layouts chosen; the mining sequence used as well as support requirements; the draw control principles required to be applied to ensure that the planned reserve is mined and that early waste ingress and stress problems are avoided.

Course Code: MINN7073A**Course Description: Block Cave Construction and Production****NQF Credits: 20****NQF Level: 9**

The course considers the initial construction of the infrastructure needed to mine the ore. The infrastructure includes items such as ore passes; the ventilation system; roadways and services. Undercutting the block to initiate caving is considered in detail. The interaction between the undercut level and the opening up of the drawbells needed to extract the ore on the level below is explained. The development and support of the extraction level as well as the process used to open the drawbells is detailed. The application of draw control to capture all ore removed from the cave is explained. The risk of airblasts and mud rushes is dealt with.

Course Code: MINN7074A

Course Description: Slope Stability Monitoring

NQF Credits: 20

NQF Level: 9

This course considers the following: Introduction to and purpose of slope stability monitoring (SSM); Legal requirements; ISO Standards and Codes of Practice for SSM; Geotechnical monitoring requirements; Project requirements with appropriate case studies; Survey monitoring design; including appropriate survey methods and instrumentation; Survey and geotechnical measurement of movements using different instruments with appropriate case studies; Interpretation and application of monitoring data; including risk assessment for slope stability and fault-event trees. The programme includes demonstrations of the latest technology available for the monitoring of movements and recent lessons learnt from actual case studies.

Course Code: MINN7075A

Course Description: Accident Investigations in Mining and Related Industries

NQF Credits: 20

NQF Level: 9

The causation of accidents in mining and related industries taking into consideration the nature of accidents and human factor considerations. Post accident actions; managing the investigation process; collecting physical evidence; collecting documentary evidence. Examining organisational concerns; management systems; and line management oversight. Preserving and controlling evidence. Determining facts. Analytical techniques. Developing conclusions and judgments of need. It will enable the participants to: Analyse; understand and interpret all aspects of accident investigations in mining and related industries.

Course Code: MINN7076A

Course Description: Sustainable Development in Mining and Industry

NQF Credits: 20

NQF Level: 9

The Sustainable Development in Mining and Industry Course covers the following: the relationship between sustainable development and business including Safety; Health; Environment as well as Community issues in mining and industry; an introduction to basic sustainable development terminology and concepts including those related to reporting and assessment; demonstrating how sustainable development concepts are used in practically in the work environment in developing strategy; risk assessment and aligning business structures.

The course enables participants to:

- 1) Describe the benefits of adopting sustainable development as a framework for business models.
- 2) Describe the core concepts of sustainable development.
- 3) Apply sustainable development concepts to business tools and structures.
- 4) Identify relevant sustainable development indicators for different industries.

Course Code: MINN7078A

Course Description: Safety & Health Leadership and Human Factors

NQF Credits: 20

NQF Level: 9

The Safety and Health Leadership and Human Factors course introduces contemporary theories and models in examining following: safety and health leadership strategies including visible felt leadership; the interdependencies between leadership components and health and safety systems; human factors and human error in health and safety; the application of behavioural safety theory and methods. Associated

issues include aligning safety & health systems and business systems; employing effective safety and health information systems; creating enabling environments; and interdependent application of system and human factor theory. The course will enable participants to

- 1) apply leadership concepts in analysing and developing safety and health leadership strategies; and
- 2) incorporate human factor theory into the design and analysis of strategies for reducing safety and health risks and preventing accidents.

Course Code: MINN7079A

Course Description: Safety; Health; Environment and Community Systems

NQF Credits: 20

NQF Level: 9

The Safety; Health; Environment & Community Systems course examines the following:

- 1) Identify relevant sustainable development indicators for different industries.
- 2) The principles involved as well as the interaction between various Safety; Health; Environment & Community (SHEC) Systems: Policy; Planning; Implementation; Measurement & Evaluation; Management Review; Continual improvement
- 3) Audit protocols: Common audit protocol; External Audits; Internal Audits
- 4) Interaction of the SHEC Systems with the business system: Leadership and SHEC climate
- 5) Information system: Leading and lagging indicators
- 6) Interaction with Enterprise-wide Risk Management.

Course Code: MINN7080A

Course Description: Earth Moving Equipment; Technology and Management

NQF Credits: 20

NQF Level: 9

The course covers the following topics: Soil and rock properties; power requirements; production measurements and calculations; machines; machine design characteristics; wheels versus tracks; ripping and blasting; draglines; excavator shovels and grading equipment; matching equipment; construction of haulage roadways; applications of Queueing theory; availability; maintenance; cost analysis; computer programmes for optimising operations.

Course Code: MINN7082A

Course Description: Occupational Health and Hygiene for Non Specialists

NQF Credits: 20

NQF Level: 9

The Occupational Health & Hygiene course will examine the following:

- 1) Occupational hygiene as the science behind health;
- 2) The management of the occupational environment
- 3) The conditions or practices conducive to health;
- 4) The following hazards: Chemical; physical or biological hazards in the workplace that could cause disease or discomfort; Physical hazards may include noise; temperature extremes; illumination extremes; ionizing or non-ionizing radiation; ergonomics; air quality and safety;
- 5) Occupational Health and Hygiene management systems;
- 6) The legal framework as well as compensation mechanisms;
- 7) National milestones on occupational health;
- 8) Wellness in the workplace as a framework to show interdependencies between the Social as well as occupational environment;
- 9) Surveillance; pro-active as well as re-active; and
- 10) It will enable the participants to: Understand; anticipate; recognise and control health hazards in the working environment with the objective of protecting worker health and well-being and safeguarding the community at large.

Course Code: MINN7083A**Course Description: Rock Cutting Technology****NQF Credits: 20****NQF Level: 9**

The course will cover the principles behind drilling; and tunnel and raise boring. An introduction to the basic techniques and equipment will be followed by a thorough treatment of geomechanical issues; equipment design issues; and modelling and prediction of boring and drilling performance. Risk management; and project management issues will be considered; as well as broader engineering considerations; such as maintenance; infrastructure; ventilation and materials handling.

Course Code: MINN7084A**Course Description: Socio-Economic Development in Mining Communities****NQF Credits: 20****NQF Level: 9**

To situate the current focus on the mining industry's expected contribution to socio-economic development (SED) within the larger context of historical and current development models applied in Africa; to demonstrate how socio-economic responsibility has caught up to the recent past's focus on environmental protection in the mining industry and to track the global trend that has resulted in Corporate Social Responsibility (CSR) as a framework for socio-economic development programming.

Course Code: MINN7085A**Course Description: Valuation of Mineral Assets****NQF Credits: 20****NQF Level: 9**

This course focuses on the purposes, principles, scope and context of Mineral Asset valuation. It allows candidates to differentiate between asset based valuations, through to security valuation and company valuations, and to gain an understanding of the risks associated with each. It covers the following topics: Definitions in valuation and mineral assets; Different types of value; Purposes of Mineral Asset Valuations; Uses of Mineral Asset valuations; Company versus asset level valuation; Scope of Mineral Asset Valuations; Types of properties being valued

Fundamental versus Market Valuation; Valuation of Rights; Valuing businesses and business combinations; International practices in Mineral Asset Valuations

International principles of Mineral Asset Valuations; Methods and approaches in Mineral Asset valuations and their applications; Valuations at different stages of the mining life cycle; Risks and limitations in Mineral Asset valuations; Inputs to Mineral Asset valuations; Mineral Resources and Mineral Reserves; Modifying factors and valuations; Discounts and premiums on Mineral Asset valuations; Valuation of Mineral Resources and Mineral Reserves; Forecasting of prices and economic indicators in Mineral Asset valuations; Valuation reports.

Course Code: MINN7086A**Course Description: Valuation and Accounting Standards****NQF Credits: 20****NQF Level: 9**

This course covers the relationship of valuation to accounting standards and accounting principles; financial statements and ratio analysis. This leads to valuations off the Balance Sheet; based on ratios and multiples; such as P/E multiples; EV etc. and also deals with International Financial Accounting Standards applied to the Extractive Industries and the implications for valuation.

In this course; students are also exposed to the various International and National Codes for valuation; and their reliance on Technical Reports and Technical Experts. This also focuses on International Valuation Standards; Definitions and Practices; and reporting requirements in terms of Listing Rules; Corporate Governance and Strategic direction. It covers the following topics:

Accounting value versus cashflow value; Financial statements and financial statement analysis; International Financial Reporting Standards and valuation; Valuation of intangibles; goodwill and impairments; Valuation of options and derivatives; International Valuations Standards; IMVAL; SAMVAL and VALMIN compared; JSE Listing Rules; Valuations and financing; Valuations and licensing; Relationship of Valuation

to accounting standards; valuation and governance and compliance; Reliance on Resource and Reserve Codes; Reliance on Technical Experts; Reporting of values to the market; Disclosure requirements; Corporate Governance requirements; Companies Act and other relevant legislation.

Course Code: MINN7087A

Course Description: Approaches to Valuation in Extractive Industries

NQF Credits: 20

NQF Level: 9

This course considers the application of the three approaches to valuation; these being:

- 1) **Cost Approaches to Extractive Industries valuations; especially as applied to Exploration and early stage development projects.** This includes cost based methods such as Multiple of Expenditure methods; Appraised Value methods etc.; and will include numerous case studies and exercises.
- 2) **Market Based approaches.** This considers and explores Market Based approaches; looking in detail at market factors and their forecasting; as well as the complex area of Market Comparable valuation; covering the appropriate equalisation and comparative measures that must be considered. This will also require case study examination and exercises.
- 3) **Income Based Approaches.** Income based approaches include Discounted Cashflow techniques and Option Pricing Methods; as well as total cashflow methods. This course will explore the development of cashflows; and the application of taxation; royalties; and financing; and the development of discount rates. This will also dispel many myths and simplifications associated with DCF analysis.

Course Code: MINN7088A

Course Description: Advanced Mineral Asset Valuation

NQF Credits: 20

NQF Level: 9

This course raises the valuation scope to Company and Security levels. It covers the following advanced topics:

Valuation off the balance sheet; Valuation of options; Debentures and financial interests and instruments; Valuation of intangibles; Valuation of Business combinations; Valuations of equity stock; Valuation of joint ventures; Valuation of Rights; Valuation of goodwill; Valuations for mergers; acquisitions; Valuations for insurance purposes; Setting terms for JVs etc based on valuations.

Course Code: MINN7089A

Course Description: Mine Planning Principles

NQF Credits: 20

NQF Level: 9

This course provides a comprehensive understanding and application of mine planning principles to the minerals industry within the context of Mineral Resource Management and Mineral Asset Management. Content may include but will not be limited to: Mine planning in the context of Mineral Resource Management and Mineral Asset Management; the Mine Value Chain; mine planning as a modelling process; modifying factors during conversion from resources to reserves; planning horizons and planning cycles; principles of optimisation in planning; principles and integration of short, medium and long term planning; principles of strategic mine planning; economic metrics in mine planning and optimisation; planning in volatile economic environments; principles of mine design and scheduling; principles of capacity design and utilisation; and right-sizing; principles of value engineering and systems engineering; applied to mine planning and design; principles of stockpiling; principles of metallurgy applied to planning; principles of cost/volume/grade optimisation over mine life; principles of tail management and mineral resource utilisation; front-end loading and inputs to mine planning; stage-gate monitoring of concept studies; pre-feasibility studies; and feasibility studies; principles of mine project planning; principles of value tracking; flexibility and constraints in mine plans; plan compliance measurement and variance analysis;

legal issues in mine planning; public reporting requirements and compliance to codes; risk evaluation and communication in mine planning; deterministic versus stochastic mine planning; manpower planning; ventilation planning; logistics planning; production planning; reconciliation; decision making and accounting principles; open-pit to underground transition; impact of sustainability on mine planning and design; course project assignment.

Course Code: MINN7090A

Course Description: Planning and Optimisation of Underground Mines

NQF Credits: 20

NQF Level: 9

This course provides a comprehensive understanding and application of mine planning principles used in underground mining. Content may include but will not be limited to: Selection of primary access; secondary access and tertiary access; ramps; declines; shafts; mine design criteria; scheduling optimisation; sizing production rate; basic mining equation (BME); basic grade equation (BGE); production planning; equipment planning; manpower planning; ventilation and refrigeration planning; geotechnical considerations; mine stope optimisation; production simulation; logistics; identification and amelioration of constraints; designing for safety and flexibility; characteristics of software utilised in underground mine planning; emerging algorithms and techniques in underground mine planning optimisation; planning for closure; course project assignment.

Course Code: MINN7091A

Course Description: Planning and Optimisation of Surface Mines

NQF Credits: 20

NQF Level: 9

This course provides a comprehensive understanding and application of mine planning principles used in surface mining. Content may include but will not be limited to: Open pit economics; cut-off grade optimisation; pit shell selection and optimisation; slope design and monitoring of stability; fleet selection and matching; batch and continuous transportation systems; converting geological model into selective mining units; pushback design and sequencing; drilling and blasting practices; characteristics of software utilised in open pit planning; reconciliation of performance against design and plan; stockpile management and optimisation; waste dumping strategies and controls; hydrology and dewatering; sustainability and environmental issues; planning for closure; course project assignment.

Course Code: MINN7092A

Course Description: Mine Financial Valuation

NQF Credits: 20

NQF Level: 9

This course provides a comprehensive understanding of the role of mine financial valuation and its application in mine planning and optimisation. In order to remain relevant to new developments in the subject matter; content may include but will not be limited to: purpose of mine financial valuation; interpreting concept of 'value'; basic business premise; optimising the balance sheet; project evaluation model; cash and accounting cash flow evaluation model; types and behaviour of costs; balancing flexibility in terms of costs; mineral price cycles and forecasting models; capital investment and ranking decisions; financing of mining projects; mining taxation; depreciation amortisation and impairment decisions; equipment replacement decisions; evaluating risk in valuation; analysis of financial statements; valuation methods and valuation codes; course project assignment.

Course Code: MINN7093A

Course Description: Applied Operations Research in Mineral Resource Management

NQF Credits: 20

NQF Level: 9

This course focuses on the application of operations research techniques to the minerals industry; particularly in Mineral Resource Management; in order to optimise the value of mineral projects. Content may include but will not be limited to: optimisation in mine planning; linear and integer programming applications in mine planning and optimisation; global optimisation as applied to mining; queuing theory as applied to mining; dispatch optimisation; decision tree and fault tree analysis in mineral projects; Monte Carlo and Discrete Event simulation methods; statistical analysis and probability theory; multi-criteria decision analysis techniques; Theory of Constraints; mine-to-mill or resource to market optimisation; course project assignment.

Course Code: MINN7094A**Course Description: Research Methodology for Mining Engineering****NQF Credits: 10****NQF Level: 9**

This course prepares candidates for research in a structured framework that provides a systematic approach to the analysis of research questions. The course is a specific aid for students returning to academia after some absence as well as those lacking basic skills in mining engineering research methodology. It includes qualitative and quantitative approaches that allow students to develop a clear and concise understanding of research report writing. Candidates will become familiar with methods of research and be able to make informed choices about alternative research methods and available experimental designs. The knowledge and skills for undertaking research as well as the nature of research and scientific writing will enable students to compile a good research proposal and report. The syllabus includes an overview of research and development (R&D) issues and emerging challenges facing the local and international mining industry; areas of specialisation in mining engineering; defining a research study area; assessing the significance of a research study; choosing a research topic; approaches to authoritative literature search and review; utilising electronic resources; referencing; statement of the problem as derived from literature search or review; formulating a research question or hypothesis; quantitative and qualitative data; sampling methodologies; methods of data analysis and presentation; data interpretation and answering research questions; compiling conclusions and recommendations; structure of a research report; dissertation or thesis; research ethics. The outcome of this course is a concept assignment.

SCHOOL OF MOLECULAR AND CELL BIOLOGY**Course Code: MCBG1000A/MCBG1001A (PT)****Course Description: Introductory Molecular and Cell Biology I****NQF Credits: 18****NQF Level: 5**

This is an introductory general biology course that focuses on the study of the cell at the molecular and cellular level. The course will review biomolecules and cellular structures with respect to their structure and function relationship, and will include introductory cell biology, molecular biology, genetics and developmental biology

SCHOOL OF MOLECULAR MEDICINE AND HAEMATOLOGY**Course Code: HAEM2001A****Course Description: Molecular and Cell Biology for Biomedical Engineers****NQF Credits: 9****NQF Level: 6****(9) (3-0-0) (1 term)**

This course introduces Biomedical Engineering students to the basic key concepts of molecular and cell biology. These include cell functioning, control, and signalling, as well as the pathological consequences of cellular dysregulation and its manifestation as cancer. Other topics include the structure and function of proteins, molecular machines, synthetic biology, gene editing and therapy, and immunology. Selected topics covering state-of-the-art biotechnology developments and bioentrepreneurship are also discussed.

SCHOOL OF PHYSICS**Course Code: PHYS1025A****Course Description: Applied Mechanics for Engineering****NQF Credits: 12****NQF Level: 5****OPTICAL PHENOMENA**

Measurement and Estimation: The Nature of Science, Physics and Its Relation to Other Fields, Models, Theories, and Laws, Measurement and Uncertainty; Significant Figures, Units, Standards, and the SI System Converting Units, Order of Magnitude: Rapid Estimating, Dimensions and Dimensional Analysis

Geometrical Optics (Plane Interfaces): Nature and Propagation of Light, Reflection and Refraction at an Interface, Reflection and Refraction at a Plane Interface, The Prism

Geometrical Optics (Curved Interfaces): Lenses, The Thin Lens, Aberration in Lenses, The Human Eye, Some Optical Instruments

Physical optics: Interference, Diffraction, Polarization

PROPERTIES OF MATTER

Work and Energy: Force, Quasi-static Motion, Work, Friction, Gravitational, Kinetic, Elastic, and Heat Energies.

Elasticity: The Hookian Spring, Stiffness constant, Stress and Strain, (Tensile, Shear, Torsion, and Bulk). Elastic Moduli, Strength of Structures.

Hydrostatics and Hydrodynamics: Density. Relative Density, Pressure, Pressure in a fluid. Hydrostatic properties of fluids, Pascal's Law, Hydraulic press, Instruments for measuring pressure, manometer, Barometer, Archimedes' Principle, Gauge pressure, Practical examples. Newtonian fluids, Equation of continuity, Bernoulli's equation, Applications of hydrodynamics, Dynamic lift, Pitot tube, Flow of fluids through pipes.

Electromagnetic-radiation: Energy, Photons, electromagnetic Waves Molecules, Atoms, Energy States, Transitions, The Spectrum, Waves, Rays Temperature, Heat,

Energy: Thermodynamic Law, Thermometers, Temperature Scales. Triple Point. Cavities.

Heat Transfer: Conduction, Convection. Radiation. Climatology. Energy Balance. Green-house Effect. Thermal conductivity, conductance, Resistance, and transmittance. U-values. Surface coefficients. Air space transmittances.

Thermal Expansion and Calorimetry: Anomalous Expansion of Water and Environmental Consequences. Specific Volume of water as a function of temperature. Effects of pressure on freezing and boiling point. Regelation. Heat and Energy Units. Calorie and Joule. Heat capacity and Specific Heat. Effect of SH of water on Climate. Change of Phase. Latent heat. Cooling by evaporation. Molecular Explanation. Effect of Impurities. Internal Energy of H₂O.

The Gas Laws: Equation of state of a gas, Universal gas constant, Avogadro's Law. Dalton's Law, Work in changing the volume, Real and ideal gases, Critical point. Indicator diagrams, heat engines.

Thermal Comfort: Vapour pressure, Humidity, P-T diagrams, Condensation, Dew point, Thermal environment, temperature control and balance, Human comfort.

ELECTRICITY AND MAGNETISM

Electric field: Contact Transfer. Electric Force. Electroscope. Conductors and insulators. Cells. Current carriers, current convention. Coulomb's Law. Permittivity. Dielectric constant. E-field. Lines of Force. Field Lines. Gauss's Law.

Electrostatic Potential and Capacitance: Electrostatic potential. The Volt. PD.

Electron-volt. Potential due to an isolated charge. PD between parallel plates and concentric spheres. The Capacitor. Capacitance. The Farad. Capacitors in series and in parallel. Energy stored in capacitors. Energy stored in series and in parallel.

Magnetism and The Magnetic Field: Historical introduction. Poles. Magnetostatics.

Domains. Ferro-, para-, Dia-, and Antiferro-magnetism. Definition of B-field. Lorentz force. Cyclotron Motion. Ampere's Law. Force Between currents. Solenoids.

Electric Charge and Circuit: Coulomb's Law, Cells, Simple Circuits. Volts. Amps. Ohms. Resistance and Resistivity. Ohmic materials.

DC Theory: Current. Ampere. Resistance. Ohm. Ohm's Law. Conductance. Mhos. Power Theorem. Combination of Resistance Theorems. Circuit Power. EMF. Batteries. Circuit Theorem. Terminal Voltage. Lost volts. Internal Resistance. Resistivity and conductivity. Temperature coefficient. Galvanometers, Ammeters, and Voltmeters.

Electromagnetic Induction and AC Theory: Faraday's Law. Inductance. Transformers. The Generator. (Rotor Diagrams. Phase. Reactance. Impedance. The R-L-C circuit. Power. rms values. Resonance. A.C. power theorem)

WAVES and PHYSICAL OPTICS

Periodic Phenomena: Period. Frequency. Circular Motion, Angular Velocity, Radians, Simple Harmonic Motion, Amplitude, Phase, Angular Frequency, SHM. Root-Mean-Square, Simple Harmonic Motion.

Superposition Effects: Beats, Doppler Effect, Stationary waves on strings and in organ pipes.

Acoustics and Sound Levels: Weber-Fechner Law, Logarithmic Levels, Physical and Physiological Parameters, Quality, SIL, bels and dB. Musical Notes. Phon Level contours. The sone scale. Acoustics.

Fields, Waves, and Physical Optics: Representation of functions of two variables, Waves, Wavelength, Wave Number, Angular Wave Number, Speed, Transverse waves on a string, Longitudinal waves on a rod, Sound Waves, Ocean Waves. Principle of superposition, Huygen's Principles, Constructive and Destructive Interference, Young's 2-slit experiment, Diffraction by Aperture and Grating, Thin Film effects, Polarisation

Course Code: PHYS1032A/PHYS1037A (PT)

Course Description: Engineering Physics 1A

NQF Credits: 18

NQF Level: 5

This course provides students with a solid grounding in the basic techniques and concepts of physics. There is both a theoretical component (covered in lectures and tutorials), and a practical component (covered in the laboratory sessions), to the course. The topics covered include foundations of physics; mechanics; fluids and statistical physics.

Course Code: PHYS1033A/PHYS1038A (PT)

Course Description: Engineering Physics 1B

NQF Credits: 18

NQF Level: 5

This course provides the students with a solid grounding in the basic techniques and concepts of physics. There is both a theoretical component (covered in lectures and tutorials), and a practical component (covered in the laboratory sessions), to the course. Topics covered include waves; electricity & magnetism and optics.

Course Code: PHYS1035A

Course Description: Applied Mechanics for Engineering

NQF Credits: 12

NQF Level: 5

This course has two components:

- 1) The engineering mechanics component gives students a solid grounding in the basic techniques and concepts of statics in Engineering Mechanics. The topics covered include force systems; equilibrium and distributed forces.
- 2) The engineering mathematical modelling component of the course provides students with the basic skills required to build mathematical descriptions of simple real world situations, with the emphasis on systems requiring differential equations or difference equations to describe them. The topics covered include ordinary differential equations and continuous and discrete mathematical models. Problem solving skills are enhanced in this course, developing the intellectual self-reliance of the students.

Course Code: PHYS2007A

Course Description: Physics II (Electrical)

NQF Credits: 15

NQF Level: 6

(15) (3-1-1) (1 term)

Relativistic mechanics: Relativity; reference frames; the Galilean Transformation; the failure of the Galilean Transformation; Special Relativity; the Lorentz Transformation; Time Dilation; The Doppler Effect; Length; Contraction; The Twin paradox; Electricity and Magnetism; The relativity of Mass and Energy; Massless particles; General Relativity.

Introduction to Quantum Mechanics: Young's double slit experiment – quantum mechanical behaviour; Wave functions; Operators; Schrodinger's Time-Dependent Wave Equation; Calculating Observables; Schrodinger's Time-Independent Wave Equation; Potential wells and tunnelling.

Quantum Mechanics of Atoms: Introduction; a full Quantum Mechanical Model of the Atom; Quantising intrinsic electron spin; quantum numbers; Probability densities; Radiative transitions; Many-electron atoms; Symmetric/antisymmetric wave functions; Pauli's exclusion principle; understanding the periodic table.

Solid State Physics: Crystalline and amorphous solids; Ionic crystals; Covalent crystals; Van der Waals forces; Metallic Bond; Living Matter; Modern Materials.

Statistical Mechanics: Introduction; Maxwell-Boltzmann Statistics; the Ideal Gas; Indistinguishability of particles and Quantum Statistics; Boson Statistics; Black-body radiation and Planck's Radiation Law; Fermion Statistics; Electrons in a metal.

From Semiconductivity to Micro-electronics: Introduction; history; highlights; the future; Quantum Mechanical review; Crystal lattices; periodic potentials; surprising results; Band structure; mobility; effective mass; holes; Fermi statistics; charge carrier concentrations; dopants; Diffusion and drift of charge carriers; junctions; depletion regions; band bending; Fermi levels; Devices (diodes; transistors; solar cells); Quantum Computing and Communication.

SCHOOL OF PHYSIOLOGY

Course Code: PHSL2004A

Course Description: Physiology and Medical Biochemistry I

NQF Credits: 48

NQF Level: 6

(48) (5.5-1.5-0.5) (2 terms)

This integrated course extends over one academic year and consists of 145 hours of lectures; 30 hours of tutorials and 40 hours of practicals. The course is a core course and designed for Dental; Physiotherapy; Occupational Therapy; Nursing and Pharmacy students; although it is also suitable for MB BCh students taking additional second year courses. Topics covered include: Body Fluids; Cell and Tissue Biochemistry; Neuromuscular function; Blood; Immune mechanisms; and inflammation; Cardiovascular and Respiratory systems; Kidney function; Gastro-intestinal system and Nutrition; Endocrinology and the Central Nervous System.

SCHOOL OF SOCIAL SCIENCES

Course Code: HIST1011A

Course Description: Global Encounters and Contemporary Realities IA

NQF Credits: 18

NQF Level: 5

This introductory course leads to a set of topics that address key issues relevant to the contemporary world: the massive economic and political influence of the United States, the contemporary environmental crisis, the gap between rich and poor regions of the world, the emergence of syncretic cultural forms, the rise of China and radical Islam. The course focuses on broader historical transnational flows and networks and offers a more detailed case study on the rise of the United States during the twentieth century. Students are able to choose between two different case-study based courses both linked coherently to the introductory course.

Course Code: INTR1010A

Course Description: The International Relations of South Africa

NQF Credits: 18

NQF Level: 5

This course builds on the knowledge established in the introductory course especially that pertaining to foreign policy decision-making and theory. This also serves to reinforce the content learnt in the introductory course and apply the theory to practice.

Course Code: PHIL1002A**Course Description: Introduction to Ethics I****NQF Credits: 18****NQF Level: 5**

This course introduces students to ethical reasoning and its applications. Examples of topics include theories of right and wrong, the relativity or objectivity of ethics, ethics and religion, equality and justice, selected ethical issues in the contemporary world.

Course Code: PHIL1003A**Course Description: Introduction to Philosophy: Knowledge and Reality I****NQF Credits: 18****NQF Level: 5**

This course introduces students to philosophy through a focused selection of topics in epistemology and metaphysics (the theories of knowledge and reality) along with the required background on the identification and evaluation of arguments.

Course Code: POLS1007A**Course Description: Introduction to Political Studies****NQF Credits: 18****NQF Level: 5**

This course introduces students to foundational themes in political studies such as ideologies, concepts and approaches to politics. The course focuses on South Africa in a globalised world, focusing on contemporary politics and issues that confront this generation in the 21st century.

Course Code: POLS3017A**Course Description: Liberty, Justice and the Politics of Difference****NQF Credits: 18****NQF Level: 7**

This course examines three major areas of controversy within analytical normative political theory since the early 1970s: the meaning and value of liberty or freedom, the entailments of distributive or social justice, and the accommodation of group claims and group diversity in modern democracies. The course explores areas of tension and complementarity between such apparently competing values as freedom and equality, and equality and recognition. Students are introduced to a range of philosophical positions within which these issues are addressed, including libertarianism, liberal egalitarianism, republicanism, communitarianism and feminism.

Course Code: SOCL1013A**Course Description: Southern Africa in the Era of Globalisation I****NQF Credits: 18****NQF Level: 5**

This course examines the process of globalisation especially in the Southern African context. Using both historical and contemporary material, it explores globalisation with related sociological questions of social change, development, culture and social inequality. The course develops students' research and critical thinking skills, to make sense of the changing social world.

Course Code: SOCL1014A**Course Description: Identity and Society I****NQF Credits: 18****NQF Level: 5**

This course introduces the theoretical and conceptual foundations of sociology. It locates the discipline's key concerns with the relationship between individuals and the social context, and examines sociological debates around modernity, social change and identity. This is achieved by an in-depth exploration of the ideas of central classical theorists. The course also develops students' content knowledge and reading and writing skills.

SCHOOL OF STATISTICS AND ACTUARIAL SCIENCE**Course Code: STAT1000A/STAT1001A/STAT1004A (PT)****Course Description: Business Statistics I****NQF Credits: 18****NQF Level: 5**

This course focuses on the following topics: Descriptive Statistics: bar graphs, histograms & ogives; measures of central tendency & spread. Descriptive Regression; Probability: Addition Rule, Conditional Probabilities, Independence, Discrete distributions (Binomial, Poisson); Continuous Distributions (Exponential, Normal & t); Inference: Hypothesis testing, confidence Intervals & p-values (means- one & two samples & proportions one sample); Time Series; Chi-square test for independence.

Course Code: STAT3029A**Course Description: Engineering Statistics****NQF Credits: 9****NQF Level: 7**

This course provides students with an appreciation that randomness and uncertainty occur in engineering as well as other real-life situations. In detail, this course is designed to provide the students with the fundamentals of descriptive statistics (graphical representation of data; measures of location; measures of variability) and probability theory based on random experiments and random events. In particular, the course will introduce the students to concepts of random variables and their probability distributions; probability of random events; conditional probability; independence; and random vectors; Lastly, the course will introduce the students to key concepts of mathematical statistics and expose them to important topics such as estimation methods, tests of hypothesis, parametric and non-parametric tests, correlation analysis, and linear regression.

WITS SCHOOL OF ARTS**Course Code: WSOA1011A****Course Description: Key Concepts in Game Design IA****NQF Credits: 18****NQF Level: 5****(18) (2-1-1) (1 term)**

The course introduces the theory and practice of game design. The theory aspect will offer an introduction to the core skills of game design. The practice component; which will be delivered in lab sessions; will require the analysis and production of analogue games using the theory introduced.

Course Code: WSOA1012A**Course Description: Key Concepts in Game Design IB****NQF Credits: 18****NQF Level: 5****(18) (2-1-1) (1 term)**

The course expands on the introduction of the theory and practice of game design. The theory aspect will offer an introduction to the core skills of game design. The practice component which is delivered in lab sessions requires the analysis and production of analogue games using the theory introduced.

Course Code: WSOA2006A**Course Description: Digital Art Design Project****NQF Credits: 24****NQF Level: 6****(24) (2 -1 -1) (1 term)**

This course focuses on applied game design. The fundamental focus of the design project is proper procedure in practice research and development; documentation of the project and writing up of the project results.

Course Code: WSOA2009A**Course Description: Introduction to Game Creation IIA****NQF Credits: 24****NQF Level: 6****(24) (2 -1 -1) (1 term)**

Students learn the history of and the technology for creating digital 2D games. In the practical part of the course students learn how to apply different game design and creation techniques.

Course Code: WSOA2010A**Course Description: Introduction to Game Creation IIB****NQF Credits: 24****NQF Level: 6****(24) (2 -1 -1) (1 term)**

In this course students learn the history of and the technology for creating digital 2D games. In the practical part of the course students learn how to apply different game design and creation techniques.

Course Code: WSOA3000A**Course Description: Introduction to the World Wide Web as Creative Medium III****NQF Credits: 18****NQF Level: 7****(18) (2 -1 -1) (1 term)**

This course covers a creative and technical exploration that uses the capabilities of the internet to communicate artistic and political ideas to a global viewership. This course introduces students to the main currents of contemporary Net. Art with an understanding of Web functionality as a communicative system. At a practice level students receive practical introduction to basic web coding techniques and creative projects that teach students to use the Web as a communicative and artistic tool.

Course Code: WSOA3003A**Course Description: Game Design IIIA****NQF Credits: 18****NQF Level: 7****(18) (2 -1 -1) (1 term)**

This course builds and expands a clear knowledge of the core elements of game design as well as the academic debates surrounding these. The course includes sections covering technical and artistic use of game mechanics, game world, system, level and interface design, content and narrative development as well as creative writing and image use.

Course Code: WSOA3004A**Course Description: Game Design IIIB****NQF Credits: 18****NQF Level: 7****(18) (2 -1 -1) (1 term)**

This course builds and expands a clear knowledge of the core elements of game design as well as the academic debates surrounding these. The course includes sections dealing with the technical and artistic use of game mechanics, game world, system, level and interface design, content and narrative development as well as creative writing and image use.

