Degrees and Diplomas in Engineering and the Built Environment

Rules and Syllabuses

ENGINEERING & THE BUILT ENVIRONMENT

Official address

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

The official address is as follows:
The Faculty Registrar, Engineering and the Built Environment
University of the Witwatersrand, Johannesburg,
Private Bag 3, Wits, 2050
Telephone number: 27-11-717-7007
Fax number: +27-11-717-7009
www address: www.wits.ac.za

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Faculty of Engineering &
the Built Environment

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<td>Award</td>
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<tr>
<td>Intermission</td>
<td>Abeyance</td>
</tr>
<tr>
<td>Pattern of Study</td>
<td>Prescribed Curriculum</td>
</tr>
<tr>
<td>Person number</td>
<td>Student number</td>
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<tr>
<td>Programme version</td>
<td>Set of rules</td>
</tr>
<tr>
<td>Unit</td>
<td>Course</td>
</tr>
<tr>
<td>Unit credit points</td>
<td>Course points (not generally related to SAQA points)</td>
</tr>
<tr>
<td>Unit level</td>
<td>Course level</td>
</tr>
<tr>
<td>Unit sets</td>
<td>Academic Plan: Major subjects /Year of study /Field of study</td>
</tr>
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SIMS definitions

The terms listed below are used throughout the Rules & Syllabuses book with the following meanings:

**Calendar** is an academic session/time period for applications.

**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.

**Milestone** is a point of assessment set for a research program and enables an academic assessment about a student’s progress to be made.

**Programme** is a course or set of courses or postgraduate research which may lead to a qualification.

**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.

**Term** is an academic year.
**Acts** create the powers and responsibilities of entities by law.

**Regulations** are subordinate to Acts and they define orders and authoritative direction.

**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 the guiding principles on a particular issue, e.g. admissions.

**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. These Rules are reviewed and published in the University Calendar each year.

**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.

**Standing orders** expand on rules and/or policies and govern the manner in which all business shall be conducted.

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

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

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 form-at.

All words appearing in italics have been defined. Where information is presented in the shaded boxes, it is intended as explanatory 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 G1.18) means a student registered for a higher qualification (see G1.14).
1.8 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.
1.9 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.

1.10 Curriculum means a course or combination of courses leading to a qualification.
1.11 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.
1.12 Examination and re-examination mean a formal, compulsory, summative, scheduled assessment.

1.13 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.

1.14 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.

1.15 Joint and/or Dual degrees mean a postgraduate degree (Masters and PhD), jointly offered by the University and an external non-South African partner institution, recognised by the Senate. Joint degree: a candidate shall receive a single co-branded degree certificate representing work completed at the University and a partner institution. Dual degree: a candidate shall receive a degree certificate from each of the partner institutions, representing work completed at the University and a partner institution respectively.

1.16a 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).

1.16b 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.

1.16c 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.

1.17 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 G1.26 for all other purposes.

1.18 Postgraduate student/Candidate means a student who is registered for a higher qualification (see G1.7).

1.19 Programme is a course or set of courses or postgraduate research which may lead to a qualification.

1.20 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.

1.21 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.

1.22 Research Report is the term reserved for the written document which forms the research component of a degree of master by coursework and research and which may include creative work or publications integral to the argument.

1.23 Semester is half an academic year.

1.24 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.
G1.24  
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.

1.25  
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 G1.26 but is still subject to the University rules, policies and procedures.

1.26  
Student means a person registered full time or part time at the University for a qualification.

1.27  
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.

1.28  
Teaching block is a quarter of an academic year.

1.29  
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.

1.30  
University means the University of the Witwatersrand, Johannesburg, unless the context indicates otherwise.

G2  
\textbf{Powers of the University}

2.1  
The University has the power in terms 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 himself or herself worthy of such a qualification.

2.4  
The University has the power in terms of section 39(4) of its Statute to withdraw the conferment of any qualification.

2.5  
The University provides higher education at or above level 5 of the National Qualification Framework as contemplated in the National Qualifications Framework Act, 2008 (Act No 67 of 2008).

2.6  
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.
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 2016, and to all students who were registered before 2016 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 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 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 G4.4.1 and G4.4.2, the Senate recognises the International English Language Testing System (IELTS) with a minimum test score of seven (7) 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.
G4.4.3
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:

a) an equivalent course offered under a different curriculum, for the same qualification in the University;

b) 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 G6.1; or

c) an equivalent course offered in another university or institution recognised for this purpose by the Senate provided that the provisions of G4.8 and G7.9 are observed. Such credits are acknowledged as part fulfilment of the requirements for a qualification.

With special permission of the Senate, short courses may carry credit towards a qualification (see G1.25) but such short courses shall not constitute more than 50 percent of the credits towards a qualification.

4.7.2 Exemptions
On admission and subject to 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 courses 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 postgraduate 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 courses 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.

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 G4.8.1 (a) and (b) i – iii 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 a student to enter a university for the degree of bachelor.

or

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 student 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 Higher Education South Africa (HESA).

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

An applicant must be issued a certificate of conditional exemption by Matriculation Board of HESA 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, the Matriculation Board of HESA 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 the Matriculation Board of HESA.

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 (ex Matriculation Board of HESA) 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 the Matriculation Board.

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 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 the Matriculation Board of HESA 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 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 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 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 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 G4.11.2 to 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.

G4.11.7

The following qualifications are senior doctorates:

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.

G4.13

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

G5 Registration

G5.1

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.

5.2 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.

5.3 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.
5.4 **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.

5.5 **Late registration**

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

5.6 **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.

5.7 **Cancellation of registration due to ill health**

5.7.1 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.

5.7.2 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.

5.7.3 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.

5.8 **Cancellation of registration as a result of unsatisfactory performance/progress**

5.8.1 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 or 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.
5.8.2 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 Deputy Vice-Chancellor (DVC): Academic, who may consult with the Dean. The decision of the DVC: Academic, acting on behalf of the Council, shall be final. Fee implications associated with the cancellation of registrations are outlined in the Schedule of Fees books.

5.8.3 The process set out in 5.8.2 will also apply to a postgraduate student registered for a programme which includes coursework.

5.9 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 G5.8, the student may be permitted or required to alter her/his registration to a special curriculum for the same qualification.

5.10 Cancellation of registration by student

5.10.1 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.

5.10.2 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.

5.11 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 Statutory minimum attendance
In terms of Joint Statute 16 the minimum period of attendance –
(i) for any degree of bachelor is three academic years.
(ii) for the degree of bachelor with honours is:

1) one academic year provided the student has completed a degree of bachelor recognised by the Senate; or

2) where the programme leading to the degree of bachelor with honours is taken simultaneously with the programme leading to the degree of bachelor, at least one academic year in addition to the minimum period prescribed for the degree of bachelor concerned, provided that the Senate may in a case considered by it to be exceptional, reduce the minimum period of attendance in respect of a degree of honours in Bachelor of Arts, Bachelor of Science, or of Bachelor of Commerce to a total of three academic years.

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 term 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 G6.6.2 above and afford her/him a reasonable opportunity to be heard.

6.6.4 Any limitation imposed on a student under 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 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 G2.7 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 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
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.
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.

G7.9: 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: a) research; b) research and coursework; or c) coursework**

Where appropriate a faculty may offer a programme leading to the degree of master by:

a) advanced study and research normally under the guidance of a supervisor/s appointed by the Senate; or
b) attendance, completion of a curriculum approved by the Senate and submission of a coursework and Research Report on a topic approved by the Senate; or
c) attendance and completion of an approved curriculum.

9.3 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 his or her 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 G1, a dissertation will be an extended piece of written work which may incorporate creative work or publications.

| G9.3 |
The terms Dissertation and Research Report are defined in G1. 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.

9.4 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.

9.5 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.

9.6 Copies of Dissertation or Research Report

A candidate for the degree of master must submit at least two bound copies, two further unbound copies and an electronic version of her/his dissertation or Research Report. The bound copies must be in a form that, in the opinion of the Senate, is suitable for submission to the examiners. Further bound copies may be required in terms of individual faculty rules. Prior to graduation, two final, corrected copies of the dissertation or Research Report must be submitted in a printed format as well as a final, corrected copy in electronic format as required by the University archivist. The candidate must attest that the electronic copy is identical to the printed copy.

| G9.6, G10.3: A candidate for a higher degree is not entitled to the return of such copies. |

9.7 Formal declaration

Together with her/his dissertation or Research Report, a candidate must submit a formal declaration stating whether –
a) it is her/his own unaided work or, if s/he has been assisted, what assistance s/he has received;
b) 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;

c) 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.

9.8 Acknowledgement of conferment of degree if material is published subsequently

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.

9.9 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.

10. 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;

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 three bound copies, two further unbound copies and an electronic version of her/his thesis. The bound copies must be in a form that, in the opinion of the Senate, is suitable for submission to the examiners.

Prior to graduation, two final, corrected copies of the thesis and any other work must be submitted in a printed format as well as a final, corrected copy in electronic format as required by the University archivist. The candidate must attest that the electronic copy is identical to the printed copy.

The rules relating to formal declaration (G9.7), acknowledgement of conferment of the qualification, (G9.8) and completion of all requirements for the degree of master (G9.9), apply with the appropriate changes.

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 Framework.


12.2 Conversion from a programme leading to the degree of master by research and dissertation 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 G5.7; or
   iii) 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 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 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 and Dissertation

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 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 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 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.

G13.3

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.

G13.5

A supplementary assessment fee may be charged.

13.6 Deferred assessments

13.6.1 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 may 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.

13.6.2 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.

13.6.3 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 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/his failure to attend such course or to perform such other requirement may result in her/his 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 –

a) s/he 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; and

c) 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 **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.
16.3 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.

16.4 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.

G16.4: 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 Vice-Chancellor.

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

G19: 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.
Joint Statutes of the Universities in the Republic of
South Africa

Section 74(6) of the Higher Education Act 101 of 1997 states that the joint statutes and joint
regulations and rules made in terms of the Universities Act, 1995 (Act 61 of 1955), continue
to exist until the date contemplated in that Act. The only provisions of the Joint Statutes
remaining in force are:

16

Subject to the provisions of an Act or of this statute, no university may, notwithstanding
anything to the contrary in its statute, admit a candidate to the degree of bachelor unless he
has –

a) registered as a matriculated student [or an NSC or NC(V) student];

b) passed such examinations or tests and complied with such conditions as the
University may impose for the completion of each course in each academic year
of study in the subjects offered for the degree: Provided that no recognition for the
purposes of a degree shall be given to any course completed in any subject in any
academic year of study unless the date of validity of his matriculation certificate
or certificate of exemption from the matriculation examination [or NSC or NC(V)]
precedes 2 April of the academic year in which such course was completed;

c) completed subsequent to the date of validity of the matriculation certificate [or the
NSC or NC(V)] or of the certificate of full exemption from the matriculation
examination issued by the Matriculation Board [of Higher Education South Africa
(HESA)] the following minimum period of attendance recognised for such degree:
Provided that in the case of a student of the University of South Africa the term
‘attendance’ shall mean ‘registration’ –

i) for the degree of Bachelor of Education (BEd) or Bachelor of Physical
Education (BEdPh) –

1) two academic years where s/he has obtained prior to this period of
attendance a degree of Bachelor of Arts or Science or another degree
accepted by the Senate of the University as equivalent thereto; or

2) one academic year where s/he has obtained prior to this period of
attendance either an approved four-year bachelor’s degree or an
approved three-year bachelor’s degree and also an approved diploma
or certificate in education;

ii) for the honours degree of bachelor –

1) one academic year provided he has completed a bachelor’s degree
recognised by the Senate of the University; or

2) where the honours degree of bachelor is taken simultaneously with
the bachelor’s degree, at least one academic year in addition to the
minimum period prescribed for the bachelor’s degree concerned:
Provided that a university may, in a case considered by it to be
exceptional, reduce the minimum period of attendance in respect of
an honours degree of Bachelor of Arts, Bachelor of Science, or
of Bachelor of Commerce to a total of three academic years.

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1 Information in square brackets is inserted for explanatory purposes.
2 This word is used in accordance with the definition in G1.12.
iii) for the degree of Bachelor of Philosophy (BPhil) two academic years after the
date of completion of a bachelor’s degree for which the minimum period of
attendance is three academic years; or one academic year after the
completion of a bachelor’s degree for which the minimum period of
attendance is four academic years;
iv) for any other bachelor’s degree: three academic years.

17

A student who was registered at a university, must, upon application for admission to
another university, submit a certificate of conduct at the first mentioned university which,
subject to section 11 of the Universities Act, is acceptable to the Senate of the university to
which admission is sought.

18

1) Subject to the provisions of subparagraph (2), the Senate of a university may accept
as part of the attendance of a student for admission to a degree of bachelor, other
than a one year honours degree of bachelor, of that university, periods of
attendance as a registered matriculated student at any other university or
institution, and may accept, as far as practicable, certificates of proficiency in any
subject issued by such other university or such other institution: Provided that the
foregoing shall also apply in the case of periods of attendance and subjects passed
for diplomas with a minimum duration of three years which have successfully
been completed at a university or another institution and on account of which the
Board has granted full or conditional exemption from the matriculation
examination [or the NSC or NC(V) examination], backdated to the commencement
of the year in which credit for such diploma was first earned; and provided further
that the provisions of subparagraph (2) shall also apply to such diplomas
completed at the same university as that at which the student concerned is to be
admitted to a degree of bachelor.

2) A candidate shall not be admitted to an ordinary degree of bachelor in terms of
sub-paragraph (1) unless –
   a) his periods of attendance are together not less than the completed period
      prescribed for admission to such degree;
   b) he attended at the university that confers the degree courses prescribed by
      that university –
      i) for a degree for which the period of attendance is three academic
         years, for at least two academic years: Provided that he has attended
         as a registered student for that degree at least half of the total number
         of courses prescribed for the degree, or
      ii) for any other degree of bachelor, at least two academic years, except
          for the degree of Bachelor of Education (BEd), or Bachelor of Physical
          Education (BEdPh), or Bachelor of Philosophy (BPhil), for which the
          period of attendance may be one academic year.

3) The Senate of a university may recognise for admission to a one-year honours
degree of bachelor at the university, courses completed for a one-year honours
degree of bachelor at any other university: Provided that at least half of the courses
required for the degree shall be attended and passed at the university granting the
degree and that the total period of attendance is not less than one year.
Rules for Engineering and the Built Environment

These rules are subordinate to and should be read in conjunction with the General Rules. The rules for awards published here are subject to change. They reflect the rules and regulations of the University as at 31 July 2016 but may be amended prior to the commencement of the 2017 academic year.

Degrees and Postgraduate Diplomas Offered

Bachelor of Architectural Studies : BAS
Bachelor of Architectural Studies with Honours : BAS(Hons)
Bachelor of Engineering Science in Biomedical Engineering : BEngSc(BME)
Bachelor of Engineering Science : BEngSc
Bachelor of Science in Construction Studies : BSc(Construction Studies)
Bachelor of Science with Honours in Construction Management : BSc(Hons)(CM)
Bachelor of Science in Engineering (in various branches) : BSc(Eng)
Bachelor of Science in Property Studies : BSc(Property Studies)
Bachelor of Science with Honours in Quantity Surveying : BSc(Hons)(QS)
Bachelor of Science in Urban and Regional Planning : BSc(URP)
Bachelor of Science with Honours in Urban and Regional Planning : BSc(Hons)(URP)
Master of Architecture (Professional) : MArch(Prof)
Master of Architecture : MArch
Master of Engineering (in various branches) : MEng
Master of Science in Building : MSc(Building)
Master of Science in Development Planning : MSc(DP)
Master of Science in Engineering (in various branches) : MSc(Eng)
Master of Science in Aeronautical Engineering : MSc(AeroEng)
Master of Science in Engineering Management : MSc(EngMan)
Master of Science in Industrial Engineering : MSc(IndEng)

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
<table>
<thead>
<tr>
<th>Degree</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Master of Science in Mechanical Engineering</td>
<td>MSc(MechEng)</td>
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<tr>
<td>Master of Science in Systems Engineering</td>
<td>MSc(SysEng)</td>
</tr>
<tr>
<td>Master of Science in Quantity Surveying</td>
<td>MSc(QS)</td>
</tr>
<tr>
<td>Master of Science in Urban and Regional Planning</td>
<td>MSc(URP)</td>
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<tr>
<td>Master of the Built Environment</td>
<td>MBE</td>
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<tr>
<td>Master of Urban Design</td>
<td>MUD</td>
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<tr>
<td>Master of Urban Studies</td>
<td>MUS</td>
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<tr>
<td>Doctor of Philosophy</td>
<td>PhD</td>
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<tr>
<td>Doctor of Architecture</td>
<td>DArch</td>
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<td>Doctor of Engineering</td>
<td>DEng</td>
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<tr>
<td>Doctor of Urban and Regional Planning</td>
<td>D(URP)</td>
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<tr>
<td>Doctor of Science in Architecture</td>
<td>DSc(Arch)</td>
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<tr>
<td>Doctor of Science in Building</td>
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<tr>
<td>Doctor of Science in Engineering</td>
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</tr>
<tr>
<td>Doctor of Science in Quantity Surveying</td>
<td>DSc(QS)</td>
</tr>
<tr>
<td>Doctor of Science in Urban and Regional Planning</td>
<td>DSc(URP)</td>
</tr>
<tr>
<td>Postgraduate Diploma in Engineering (in various branches)</td>
<td>PGDip(Eng)</td>
</tr>
<tr>
<td>Postgraduate Diploma in Planning</td>
<td>PGDipPlanning</td>
</tr>
<tr>
<td>Postgraduate Diploma in Property Development and Management</td>
<td>PGDipPDM</td>
</tr>
</tbody>
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The Bachelor of Science in Engineering may be awarded in any one of the following branches:

- Aeronautical Engineering*
- Chemical Engineering**
- Civil Engineering
- Electrical Engineering
- Industrial Engineering*
- Mechanical Engineering*
- Metallurgy and Materials Engineering**
- Mining Engineering

* 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:

Electrical Engineering: Information Engineering

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 an Architectural Technologist. The postgraduate Master of Architecture (Professional) - MArch(Prof) qualifies the graduate for registration as a Candidate Professional Architect. 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.

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
The BAS and MArch(Prof) awards are validated by the SACAP and 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 Institution 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.

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
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.

P1 APPLICATION OF RULES
See G3.

Bachelor Qualifications

P2 ADMISSION

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

The minimum requirements for admission to the qualifications as indicated in table 2.1 are as follows:

Table 2.1

<table>
<thead>
<tr>
<th>BAS</th>
<th>BSc(URP)</th>
<th>BSc(CS)</th>
<th>BSc(PropStud)</th>
<th>BSc(Eng) (all branches)</th>
<th>BEngSc</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.1.1</td>
<td>P2.1.2</td>
<td>P2.1.2</td>
<td>P2.1.2</td>
<td>P2.1.3</td>
<td>P2.1.3</td>
</tr>
</tbody>
</table>

2.1.1 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.

2.1.2 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.

2.1.3 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.

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 Minimum requirements for admission - non NSC matriculants

The minimum requirements for admission to the qualifications as indicated in table 2.2 are as follows:

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
Table 2.2

<table>
<thead>
<tr>
<th>BAS</th>
<th>BSc(URP)</th>
<th>BSc (CS)</th>
<th>BSc(Prop Stud)</th>
<th>BSc(Eng) (all branches)</th>
<th>BEngSc</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.2.1</td>
<td>P2.2.1</td>
<td>P2.2.1</td>
<td>P2.2.1</td>
<td>P2.2.2 and P2.2.3</td>
<td>P2.2.2 and P2.2.3</td>
</tr>
</tbody>
</table>

2.2.1 A pass in Mathematics at the Higher Grade or a standard of at least 60 percent in Mathematics at the Standard Grade.

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

2.2.3 A pass in both Mathematics and Physical Science at the Higher Grade. In exceptional circumstances, the Senate may accept a standard of at least 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.

P2.1 & P2.2: Compliance with minimum requirements does not guarantee admission.

2.3 Admission to Bachelor of Architectural Studies with 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;

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.

2.4 Admission to Bachelor of Science with 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;

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.

2.5 Admission to Bachelor of Science with 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;

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.

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. Qualification includes any degree, diploma, certicate, licentiate, or any other educational attainment that is offered by the University as stipulated in its list of qualifications.
2.6 Admission to Bachelor of Science with 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.

2.7 i) Change of registration from 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:

a) 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

b) 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.

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

2.7 ii) 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).

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
2.7 iii) Change of registration from Bachelor of Engineering Science (Digital Arts) to Bachelor of Science in Engineering in the branch of Electrical Engineering (Information Engineering)

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

P2.7 Admission of BEngSc(BME) graduates into BSc(Eng) – Electrical
A person who has completed the BEngSc(BME) may be admitted to the third year of study for the BSc(Eng) in the branch of Electrical Engineering and may select either Information Engineering or Electrical Engineering.

2.8 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.

2.9 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:

- CHEM1012 Chemistry I
- CHEM2003 Chemistry II
- CHEM3028 Chemistry III
- CHMT1002 Introduction to Process and Materials I
- CHMT2011 Computing for Process Engineering II
- CHMT2013 Process Engineering Fundamentals II
- CHMT2014 Energy Balances and Applications II
- ELEN1003 Critical Thinking I
- ELEN2000 Electrical Engineering
- ECON1002 Economic concepts IA
- MATH1034 Algebra I
- MATH1036 Calculus I
- MATH2011 Mathematics II (Engineering)
- PHYS1000 Physics I (Major)
- PSYC2019 Human Resource Psychology II

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. Qualification includes any degree, diploma, certicate, licentiate, or any other educational attainment that is offered by the University as stipulated in its list of qualifications.
### 2.10 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:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM1012</td>
<td>Chemistry I</td>
</tr>
<tr>
<td>CHEM2001</td>
<td>Chemistry II A</td>
</tr>
<tr>
<td>CHEM2007</td>
<td>Materials Science II</td>
</tr>
<tr>
<td>CHEM3037</td>
<td>Materials Science III</td>
</tr>
<tr>
<td>CHMT1002</td>
<td>Introduction to Process and Materials</td>
</tr>
<tr>
<td>CHMT2009</td>
<td>Introduction to Mineralogy and Earth Science II</td>
</tr>
<tr>
<td>CHMT2011</td>
<td>Computing for Process Engineering II</td>
</tr>
<tr>
<td>CHMT2017</td>
<td>Introduction to Extractive Metallurgy II</td>
</tr>
<tr>
<td>CHMT2018</td>
<td>Practical Metallurgy II</td>
</tr>
<tr>
<td>ELEN1003</td>
<td>Critical Thinking I</td>
</tr>
<tr>
<td>ECON1002</td>
<td>Economic Concepts IA</td>
</tr>
<tr>
<td>HIST1010</td>
<td>A Social History of Technology I</td>
</tr>
<tr>
<td>MATH1034</td>
<td>Algebra I</td>
</tr>
<tr>
<td>MATH1036</td>
<td>Calculus I</td>
</tr>
<tr>
<td>MATH2007</td>
<td>Multivariable Calculus II</td>
</tr>
<tr>
<td>MATH2018</td>
<td>Group Theory II</td>
</tr>
<tr>
<td>MATH2019</td>
<td>Linear Algebra II</td>
</tr>
<tr>
<td>PHYS1000</td>
<td>Physics I (Major)</td>
</tr>
</tbody>
</table>

### 2.11 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:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM1013</td>
<td>Chemistry I (Auxiliary)</td>
</tr>
<tr>
<td>MATH1001</td>
<td>Mathematics I</td>
</tr>
<tr>
<td>MATH2011</td>
<td>Mathematics II</td>
</tr>
<tr>
<td>MECN1001</td>
<td>Introduction to Mechanical Engineering and Design</td>
</tr>
<tr>
<td>MECN1003</td>
<td>Engineering Drawing</td>
</tr>
<tr>
<td>MECN2000</td>
<td>Fluid Mechanics I</td>
</tr>
<tr>
<td>MECN2011</td>
<td>Applied Mechanics A</td>
</tr>
<tr>
<td>MECN2012</td>
<td>Computing Skills and Software Development</td>
</tr>
<tr>
<td>MECN2005**</td>
<td>Mechanical Engineering Laboratory I</td>
</tr>
<tr>
<td>MECN2006</td>
<td>Thermodynamics I</td>
</tr>
</tbody>
</table>

---

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
**MECN 2005 Mechanical Engineering Laboratory I** is a requirement for students that completed **MECN3023 Introduction to Nuclear Engineering** and **MECN3024 Introduction to Nuclear Safety** in or before 2016.

**MECN 2005 Mechanical Engineering Laboratory I**, **MECN 3023 Introduction to Nuclear Engineering** and **MECN3024 Introduction to Nuclear Safety** are replaced by **MECN3033 Introduction to Nuclear Engineering** and **MECN3034 Introduction to Nuclear Safety** in 2017.

2.12 **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.

P2.12.a In exceptional cases, subject to timetable clashes, prerequisites and co-requisites, a second year BSc(Eng) student may be permitted to include in her/his curriculum one or more third year courses from Industrial Engineering.

P3 **CURRICULA**

For details of the courses comprising the different curricula refer to Rule P.7.

3.1 **Length of curriculum**

The length of curriculum extends over not fewer than the number of academic years indicated in table 3.1.
Table 3.1 (f/t = full time; p/t = part time)

<table>
<thead>
<tr>
<th>BAS</th>
<th>BAS(Hons)</th>
<th>BSc(Hons) (QS)</th>
<th>BSc(URP)</th>
<th>BSc(Hons) (URP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3f/t</td>
<td>1f/t or 2p/t</td>
<td>1f/t</td>
<td>3f/t</td>
<td>1f/t or 2p/t</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BSc(Hons) (CM)</th>
<th>BSc(CS)</th>
<th>BSc(PropStud)</th>
<th>BSc(Eng) (all branches)</th>
<th>BEngSc; BEngSc BME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1f/t</td>
<td>3f/t</td>
<td>4f/t</td>
<td>4f/t 6p/t</td>
<td>3f/t</td>
</tr>
</tbody>
</table>

3.2 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 G16.2.

3.3 Special curriculum in Mining Engineering for Science students

A student who has obtained credit in the courses listed below, while registered for the Bachelor of Science in the Faculty of Science may be admitted by the Senate to the curriculum set out in P7.7.8.5 for the Bachelor of Science in Engineering in the branch of Mining Engineering:

- CHEM1012 Chemistry I, or
- CHEM1013 Chemistry IA and
- CHEM1014 Chemistry IB
- PHYS1000 Physics I (Major) or
- PHYS1001 Physics I (Auxiliary) or
- COMS1001, COMS1002, COMS1003 and COMS1004 Computer Science
- GEOL1000 Geology I
- GEOL2000 Complementary Earth Science II
- MATH1001 Mathematics I (Major)
- MINN1000 Mining Graphics and Design
- MINN2000 Computer Applications in Mining
- MINN2004 Engineering Surveying
- MINN3013 Mining A

P4 GRANTING OF CREDIT

4.1 Granting of credit in BSc(Eng) and BEngSc

4.1.1 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.

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
4.1.2 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 herself/himself 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:

- CHMT1002A Introduction to Process and Materials Engineering
- CHMT2014A Energy Balances and Applications
- CHMT2015A Practical Metallurgy
- CHMT3004A Chemical Engineering Laboratory
- CHMT3006A Process Design Principles
- CHMT3026A Process and Materials Design
- CHMT4003A Metallurgical Design
- CHMT4004A Research Project
- CHMT4009A Chemical Engineering Design
- CHMT4019A Chemical Engineering Research Project
- ELEN1003A Critical Thinking
- ELEN1004A Engineering Skills and Design
- 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
- MECN3003A Aeronautical Engineering Laboratory I
- MECN3004A Industrial Engineering Design
- MECN3005A Aircraft Design
- MECN3006A Industrial Engineering Laboratory
- MECN3007A Mechanical Engineering Laboratory II
- MECN4005A Design Project
- MECN4006A Research Project
- MECN4015A Business Studies
- MINN3000A Industrial and Research Seminars I
- MINN3002A Mining Engineering Laboratories
- MINN4002A Industrial and Research Seminars II

**Note:** 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
MINN4006A  Mine Design
MINN4007A  Project Report
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 G13.3 regarding satisfactory participation shall apply.

P4.1.2 (b): A supplementary examination will normally not be granted in a course in which a substantial proportion of the final mark is derived from the work done during the academic year, or from reports on project, practical or laboratory work.

4.2 Granting of credit in BAS, BSc(CS), BSc(Property Studies), BSc(URP)

4.2.1 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.

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

- ARPL1000  Architectural Design and Theory I
- ARPL1001  Theory and Practice of Construction I
- ARPL1015A  Introduction to Environmental Interpretation
- ARPL1016A  Introduction to Settlement Form and Design
- ARPL2000  Architectural Design and Theory II
- ARPL2002  Theory and Practice of Construction II
- ARPL2015A  Contemporary Design and Environmental Issues in South Africa
- ARPL3000  Theory and Practice of Construction III
- ARPL3005  Architectural Design and Theory III
- ARPL3012A  Comparative Approaches to Urban Design
- ARPL3026A  Integrated Development Planning

P4.2.2: Faculty standing orders may from time to time be amended.

P5 ACADEMIC PROGRESSION
Subject to P7 the following rules apply

5.1 Deleted
5.2 Deleted
5.3 Deleted

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
5.4 Bachelor of Architectural Studies, Bachelor of Science in Construction Studies, Bachelor of Science in Property Studies, Bachelor of Science in Urban and Regional Planning

5.4.1 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 5.4.1 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 5.4.1

<table>
<thead>
<tr>
<th>Degree</th>
<th>2nd year</th>
<th>3rd year</th>
<th>4th year</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAS</td>
<td>ARPL1000 Architectural Design and Theory I</td>
<td>ARPL2000 Architectural Design and Theory II</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>ARPL1001 Theory and Practice of Construction I</td>
<td>ARPL2002 Theory and Practice of Construction II</td>
<td></td>
</tr>
<tr>
<td>BSc(CS)</td>
<td>BUQS1006A Construction Technology I</td>
<td>BUQS2004A Construction Technology II</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>BUQS1008A Quantities and Specifications I</td>
<td>BUQS2005A Quantities and Specifications II</td>
<td></td>
</tr>
<tr>
<td>BSc(Prop Stud)</td>
<td>MATH1039A Mathematics for Property Studies</td>
<td>BUQS2014A Real Estate Corporate Finance</td>
<td>BUQS3023A Real Estate Finance</td>
</tr>
<tr>
<td></td>
<td>STAT1000A Business Statistics</td>
<td>BUQS2009A Econometrics for Property Studies</td>
<td>BUQS3022A Real Estate Valuation</td>
</tr>
<tr>
<td></td>
<td>BUQS1009A Real Estate Principles</td>
<td>BUQS2011A Real Estate Market Analysis</td>
<td>BUQS3021A Real Estate Management</td>
</tr>
<tr>
<td></td>
<td>ECON1012A Economics IA – Microeconomics</td>
<td>BUQS2012A Real Estate Law</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BUQS3023A Real Estate Finance</td>
</tr>
<tr>
<td>BSc(URP)</td>
<td>ARPL1015A Introduction to Environmental Interpretation</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>ARPL1016A Introduction to Settlement Form and Design</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.4.2 A student who does not proceed to the next year of study in terms of P5.4.1 above, must include in her/his curriculum all the courses in which s/he failed to obtain

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
credit. Subject to the prerequisites set out in P7, 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.

5.4.3 A student who is permitted to proceed to the next year of study in terms of P5.4.1 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.

5.4.4 Except with the permission of the Senate, a student who fails to obtain credit in the applicable Research Report (BUQS4041) and who is permitted to repeat the course shall be required to select a new subject, approved by the Senate, in terms of the syllabus prescribed for that course.

5.5 Bachelor of Science in Engineering and Bachelor of Engineering Science

5.5.1 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.

5.5.2 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.

5.5.3 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.

5.5.4 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.

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
5.6 Deleted

5.7 Bachelor of Science with Honours in 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.

P6 MINIMUM REQUIREMENTS OF STUDY

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.

6.1 Bachelor of Architectural Studies

In all years of study a student must -

a) obtain credit in courses for which the total of the credits is at least 60% of the total credits for which s/he is registered and

b) pass every course that s/he is repeating.

6.2 Bachelor of Engineering Science

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 at least 60% 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 P4.1.1) of at least 45%.

6.3 Bachelor of Science in Construction Studies and Bachelor of Science in Property Studies

In all years of study a student must:

a) obtain credit in courses for which the total of the credits is at least 60% of the total credits for which s/he is registered and

b) pass every course that s/he is repeating.

6.4 Bachelor of Science in Engineering

6.4.1 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 at least 60% of the total credits for the first year curriculum of the relevant branch of the BSc(Eng);

or

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
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 P4.1.1) of at least 45%.

6.4.2 BSc(Eng) – Students admitted to second year in terms of P2.8

A student must –

a) In her/his first year of registration for the second year curriculum, obtain credit in courses for which the total of the credits is at least 60% of the total credits for the second year curriculum of the relevant branch of the BSc(Eng), or

b) If registered for the second year other than for the first time, or for third or fourth year obtain an aggregate (as defined in Rule P.4.1.1) of at least 45%.

c) Pass every course that s/he is repeating.

6.5 Bachelor of Science in Urban and Regional Planning

In all years of study a student must:

a) obtain credit in courses for which the total of the credits is at least 60% of the total credits for which s/he is registered

and

b) must pass any course which s/he may be repeating.

P7 CURRICULA

7.1 First Aid and Occupational Health and Safety Requirements

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), BEngSc, BAS, BSc(URP), BSc(CS), and BSc(Property 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.

7.2 Deleted

7.3 Bachelor of Architectural Studies (FB000)

(Note: The points in 7.3 are for the purpose of determining the minimum requirements of study (P6.1). They do not necessarily correspond with the South African Qualifications Authority (SAQA) credits. For the SAQA credits for each course, see the Syllabus section at the end of this book.)

7.3.1 Restriction on admission to courses: prerequisite requirements

A student shall not be admitted to courses listed under A below unless s/he has obtained credit in or been exempted from the preceding courses listed under B below:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
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<tbody>
<tr>
<td>ARPL2000</td>
<td>ARPL1000</td>
</tr>
<tr>
<td>ARPL2002</td>
<td>ARPL1001</td>
</tr>
<tr>
<td>Architectural Design and Theory II</td>
<td>Architectural Design and Theory I</td>
</tr>
<tr>
<td>and Theory and Practice of Construction II</td>
<td>and Theory and Practice of Construction I</td>
</tr>
</tbody>
</table>

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
### 7.3.2 First year of study

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>NQF Level</th>
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<tbody>
<tr>
<td>APPM1000</td>
<td>Applied Mathematics (18) (NQF 5)</td>
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<td>Architectural Design and Theory I (36) (NQF 5)</td>
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<tr>
<td>ARPL1001</td>
<td>Theory and Practice of Construction I (36) (NQF 5)</td>
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<tr>
<td>ARPL1002</td>
<td>Introduction to Structures (18) (NQF 5)</td>
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<tr>
<td>ARPL1003</td>
<td>Architectural Representation I (36) (NQF 5)</td>
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<tr>
<td>ARPL1013</td>
<td>Histories and Theories of Architecture I (36) (NQF 5)</td>
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</table>

### 7.3.3 Second year of study

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARPL2000</td>
<td>Architectural Design and Theory II (36) (NQF 6)</td>
<td>36</td>
<td>6</td>
</tr>
<tr>
<td>ARPL2002</td>
<td>Theory and Practice of Construction II (36) (NQF 6)</td>
<td>36</td>
<td>6</td>
</tr>
<tr>
<td>ARPL2003</td>
<td>Architectural Representation II (36) (NQF 6)</td>
<td>36</td>
<td>6</td>
</tr>
<tr>
<td>ARPL2012</td>
<td>Histories and Theories of Architecture II (36) (NQF 6)</td>
<td>36</td>
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<tr>
<td>CIVN2003</td>
<td>Civil Engineering Theory I (36) (NQF 6)</td>
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</table>

### 7.3.4 Third year of study

<table>
<thead>
<tr>
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<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ARPL3031</td>
<td>Theory and Practice of Construction III (30) (NQF 7)</td>
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<tr>
<td>ARPL3002</td>
<td>Small Office Practice (18) (NQF 7)</td>
<td>18</td>
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<tr>
<td>ARPL3005</td>
<td>Architectural Design and Theory III (36) (NQF 7)</td>
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<tr>
<td>ARPL3021</td>
<td>Histories and Theories of Architecture III (36) (NQF 7)</td>
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<tr>
<td>CIVN3005</td>
<td>Civil Engineering Theory II (36) (NQF 7)</td>
<td>36</td>
<td>7</td>
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</tbody>
</table>

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7.4 Bachelor of Architectural Studies with Honours (FHA00)

Table:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARPL4000A</td>
<td>Advanced Design Studio (45)</td>
<td>45</td>
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</tr>
<tr>
<td>ARPL4001A</td>
<td>Design Studio (45)</td>
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</tr>
<tr>
<td>ARPL4002A</td>
<td>Contemporary Architectural Theory (18)</td>
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<td>8</td>
</tr>
<tr>
<td>ARPL4003A</td>
<td>Advanced Theory and Practice of Construction (18)</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>ARPL4004A</td>
<td>Advanced History of Architecture and Urbanism (18)</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>ARPL4005A</td>
<td>Research Project (36)</td>
<td>36</td>
<td>8</td>
</tr>
</tbody>
</table>

7.5 Bachelor of Engineering Science*

P7.5: * Prerequisites for these courses are listed in the Syllabuses section.

7.5.1 Bachelor of Engineering Science in Biomedical Engineering (EBA00)

7.5.1.1 First year of study

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL1000A</td>
<td>Introductory Life Sciences (36)</td>
<td>36</td>
<td>5</td>
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<tr>
<td>CHEM1012A</td>
<td>Chemistry I (36)</td>
<td>36</td>
<td>5</td>
</tr>
<tr>
<td>ELEN1000A</td>
<td>Electric Circuits (15)</td>
<td>15</td>
<td>5</td>
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<tr>
<td>MATH1014A</td>
<td>Mathematics I (30)</td>
<td>30</td>
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<tr>
<td>PHYS1014A</td>
<td>Physics IE (30)</td>
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<td>5</td>
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<td>PHYS1015A</td>
<td>Mechanics (30)</td>
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</table>

A student shall also complete the following course to the satisfaction of the Senate:

ELEN1997A Vacation Design

7.5.1.2 Second year of study

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>NQF Level</th>
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</thead>
<tbody>
<tr>
<td>APPM2013A</td>
<td>Biomedical Statistics and Numerical Methods (6)</td>
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<tr>
<td>ELEN2001A</td>
<td>Electronics I (18)</td>
<td>18</td>
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<tr>
<td>ELEN2003A</td>
<td>Electric and Magnetic Systems (18)</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>ELEN2004A</td>
<td>Software Development I (18)</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>ELEN2005A</td>
<td>Signals and Systems I (12)</td>
<td>12</td>
<td>6</td>
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<tr>
<td>ELEN2006A</td>
<td>Microprocessors (15)</td>
<td>15</td>
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<tr>
<td>HAEM2001A</td>
<td>Molecular and Cell Biology (9)</td>
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<tr>
<td>MATH2014A</td>
<td>Mathematics II (33)</td>
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<tr>
<td>PHYS2007A</td>
<td>Physics II (Electrical)</td>
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7.5.1.3 Third year of study

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>NQF Level</th>
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<td>ANAT2020A</td>
<td>Anatomy (48)</td>
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<tr>
<td>CHMT3017A</td>
<td>Biomedical Transport Phenomena (6)</td>
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<tr>
<td>ELEN3008A</td>
<td>Biomedical Measurement, Instrumentation and Imaging (12)</td>
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<tr>
<td>ELEN3012A</td>
<td>Signals and Systems IIA (12)</td>
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<td>7</td>
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<td>ELEN3014A</td>
<td>Biomedical Signals, Systems and Control (9)</td>
<td>9</td>
<td>7</td>
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<tr>
<td>PHSL2004A</td>
<td>Physiology and Medical Biochemistry I (48)</td>
<td>48</td>
<td>7</td>
</tr>
</tbody>
</table>

7.5.2 Bachelor of Engineering Science (Digital Arts) (EBA01)

7.5.2.1 First year of study

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
ELEN1000A  Electric Circuits (15) (NQF 5)
MATH1014A  Mathematics I (30) (NQF 5)
PHYS1014A  Physics IE (30) (NQF 5)
PHYS1015A  Mechanics (30) (NQF 5)
WSOA1011A  Key Concepts in Game Design I (18) (NQF 5)
WSOA1012A  Key Concepts in Game Design II (18) (NQF 5)
A student shall also complete the following course to the satisfaction of the Senate:
ELEN1997A  Vacation Design

7.5.2.2 Second year of study

COMS2004A  Data Structure and Algorithms (18) (NQF 6)
ELEN2001A  Electronics I (18) (NQF 6)
ELEN2004A  Software Development I (18) (NQF 6)
ELEN2006A  Microprocessors (15) (NQF 6)
MATH2014A  Mathematics II (33) (NQF 6)
WSOA2006A  Digital Art Design Project (24) (NQF 6)
WSOA2009A  Introduction to Game Creation II A (24) (NQF 6)
WSOA2010A  Introduction to Game Creation II B (24) (NQF 6)

7.5.2.3 Third year of study

ELEN2003A  Electric and Magnetic Systems (18) (NQF 7)
ELEN2005A  Signals and Systems I (12) (NQF 7)
ELEN3020A  Professional Practice and Software Development (18) (NQF 7)
WSOA3000A  Introduction to the World Wide Web as Creative Medium III (18) (NQF 7)
WSOA3003A  Game Design IIIA (18) (NQF 7)
WSOA3004A  Game Design IIIB (18) (NQF 7)

7.6 Construction Management

7.6.1 Bachelor of Science with Honours in Construction Management (FH005)

BUQS4026  Construction Law (18) (NQF 8)
BUQS4027  Construction Project Management (18) (NQF 8)
BUQS4028  Simulated Project (18) (NQF 8)
BUQS4029  Advanced Construction Management (18) (NQF 8)
BUQS4030  Advanced Building Science (18) (NQF 8)
BUQS4031  Research Report (39) (NQF 8)
CIVN4013  Civil Engineering Theory in Construction (18) (NQF 8)
A student shall also complete the following course to the satisfaction of the Senate:
BUQS1990  Practical Training

7.7 Bachelor of Science in Engineering*

P7.7: * Prerequisites for courses listed in the curricula are reflected in the Syllabuses section.

7.7.1 Branch of Aeronautical Engineering (EFA06)

7.7.1.1 First year of study

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
### 7.7.1.2 Second year of study

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>NQF Level</th>
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<tr>
<td>ELEN2000A</td>
<td>Electrical Engineering</td>
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<td>MATH2011A</td>
<td>Mathematics II</td>
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<td>MECN2000A</td>
<td>Fluid Mechanics I</td>
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<td>MECN2005A</td>
<td>Mechanical Engineering Laboratory I</td>
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<td>MECN2006A</td>
<td>Thermodynamics I</td>
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<td>MECN2010A</td>
<td>Introduction to Materials Science and Engineering</td>
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<td>MECN2011A</td>
<td>Applied Mechanics A</td>
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<td>Computing Skills and Software Development</td>
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### 7.7.1.3 Third year of study

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<td>MATH3026A</td>
<td>Mathematical Methods</td>
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<td>MECN3001A</td>
<td>Aircraft Structures I</td>
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<td>Fluid Mechanics II</td>
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<td>Introduction to Aeronautics</td>
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<td>MECN3010A</td>
<td>Mechanics of Solids I</td>
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<td>MECN3032A</td>
<td>Numerical Methods and Statistics</td>
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<tr>
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<td>Mechanical Vibrations</td>
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<td>MECN3028A</td>
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A student shall also complete the following course to the satisfaction of the Senate:

- MECN1998A Vacation Work I (Mechanical)

### 7.7.1.4 Fourth year of study

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>MECN1004A</td>
<td>Selected Topics in Social Science</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>MECN4005A</td>
<td>Design Project</td>
<td>39</td>
<td>8</td>
</tr>
<tr>
<td>MECN4006A</td>
<td>Research Project</td>
<td>39</td>
<td>8</td>
</tr>
<tr>
<td>MECN4020A</td>
<td>Systems Management and Integration</td>
<td>12</td>
<td>8</td>
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<tr>
<td>MECN4024A</td>
<td>Gas Dynamics and Propulsion</td>
<td>15</td>
<td>8</td>
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<tr>
<td>MECN4025A</td>
<td>Aerodynamics</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>MECN4026A</td>
<td>Flight Dynamics</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>MECN4027A</td>
<td>Aircraft Structures II</td>
<td>12</td>
<td>8</td>
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<tr>
<td>MECN4029A</td>
<td>Mechatronics II</td>
<td>15</td>
<td>8</td>
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A student shall also complete the following courses to the satisfaction of the Senate:

---

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### Branch of Chemical Engineering (EFA00)

#### First year of study

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM1031A</td>
<td>Chemistry I (33)</td>
<td>33</td>
<td>5</td>
</tr>
<tr>
<td>CHMT1002A</td>
<td>Introduction to Process and Materials Engineering (30)</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>PHYS1025A</td>
<td>Physics (30)</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>MATH1014A</td>
<td>Mathematics I (30)</td>
<td>30</td>
<td>5</td>
</tr>
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</table>

A student shall also complete the following courses, the marks of which may be averaged for the purpose of progression:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELEN1003A</td>
<td>Critical Thinking (12)</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>HIST1010A</td>
<td>A Social History of Technology (9)</td>
<td>9</td>
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#### Second year of study

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMT2011A</td>
<td>Computing for Process Engineering (15)</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>CHMT2013A</td>
<td>Process Engineering Fundamentals (33)</td>
<td>33</td>
<td>6</td>
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<tr>
<td>CHMT2014A</td>
<td>Energy Balances and Applications (18)</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>CHEM2017A</td>
<td>Chemistry II (24)</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>ELEN2000A</td>
<td>Electrical Engineering (18)</td>
<td>18</td>
<td>6</td>
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<tr>
<td>MATH2011A</td>
<td>Mathematics II (27)</td>
<td>27</td>
<td>6</td>
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</table>

A student shall also complete the following course:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON1002A</td>
<td>Economic Concepts 1A (18)</td>
<td>18</td>
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</table>

#### Third year of study

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMT3000A</td>
<td>Transport Phenomena (27)</td>
<td>27</td>
<td>7</td>
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<tr>
<td>CHMT3003A</td>
<td>Chemical Engineering Thermodynamics (27)</td>
<td>27</td>
<td>7</td>
</tr>
<tr>
<td>CHMT3004A</td>
<td>Chemical Engineering Laboratory (18)</td>
<td>18</td>
<td>7</td>
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<tr>
<td>CHMT3005A</td>
<td>Mass Transfer Operations (12)</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>CHMT3036A</td>
<td>Chemical Reaction Engineering (20)</td>
<td>20</td>
<td>7</td>
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<tr>
<td>CHMT3037A</td>
<td>Process Design Principles (22)</td>
<td>22</td>
<td>7</td>
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<tr>
<td>CHMT3008A</td>
<td>Numerical Methods (12)</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>CHMT3024A</td>
<td>Environmental Process Engineering (9)</td>
<td>9</td>
<td>7</td>
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</tbody>
</table>

A student shall also complete the following course to the satisfaction of the Senate:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>NQF Level</th>
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</thead>
<tbody>
<tr>
<td>CHMT1996A</td>
<td>Vacation Work (Chemical)</td>
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</table>

#### Fourth year of study

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMT4005A</td>
<td>Management for Process Engineers (12)</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>CHMT4006A</td>
<td>Solid Fluid Systems (9)</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>CHMT4009A</td>
<td>Chemical Engineering Design (30)</td>
<td>30</td>
<td>8</td>
</tr>
<tr>
<td>CHMT4011A</td>
<td>Process Control (12)</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>CHMT4019A</td>
<td>Chemical Engineering Research Project (30)</td>
<td>30</td>
<td>8</td>
</tr>
<tr>
<td>CHMT4029A</td>
<td>Biochemical Engineering (9)</td>
<td>9</td>
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</table>

Students are also required to complete at least three of the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>NQF Level</th>
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</thead>
<tbody>
<tr>
<td>CHMT4000A</td>
<td>Hydrometallurgy (9)</td>
<td>9</td>
<td>8</td>
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</tbody>
</table>

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7.7.3 **Branch of Civil Engineering (EFA01)**

7.7.3.1 **First year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>NQF</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM1033A</td>
<td>Chemistry I (Auxiliary)</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>CIVN1001A</td>
<td>Engineering Computing</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>CIVN1004A</td>
<td>Engineering Skills (Civil)</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>MATH1014A</td>
<td>Mathematics I</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>PHIL1001A</td>
<td>Critical Thinking and Philosophical Reasoning I</td>
<td>12</td>
<td>5</td>
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<tr>
<td>PHYS1014A</td>
<td>Physics I</td>
<td>30</td>
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<tr>
<td>PHYS1015A</td>
<td>Mechanics</td>
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7.7.3.2 **Second year**

<table>
<thead>
<tr>
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<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CIVN2000A</td>
<td>Earth Materials and Processes</td>
<td>15</td>
<td>6</td>
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<tr>
<td>CIVN2004A</td>
<td>Engineering Planning and Design</td>
<td>15</td>
<td>6</td>
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<tr>
<td>CIVN2013A</td>
<td>Introduction to Environmental Engineering</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>CIVN2007A</td>
<td>Economics and Management</td>
<td>15</td>
<td>6</td>
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<tr>
<td>CIVN2008A</td>
<td>Materials and Structures I</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>CIVN2009A</td>
<td>Materials and Structures II</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>CIVN2010A</td>
<td>Numerical Methods</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>CIVN2011A</td>
<td>Probability Theory and Mathematical Statistics for Engineers</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>MATH2012A</td>
<td>Mathematics II</td>
<td>15</td>
<td>6</td>
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<tr>
<td>MINN2004A</td>
<td>Engineering Surveying</td>
<td>21</td>
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A student shall also complete the following courses to the satisfaction of the Senate:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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</thead>
<tbody>
<tr>
<td>CIVN1997A</td>
<td>Practical Training (Civil)</td>
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<tr>
<td>CIVN1998A</td>
<td>Vacation Work I (Civil)</td>
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</tbody>
</table>

7.7.3.3 **Third year of study**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>NQF</th>
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</thead>
<tbody>
<tr>
<td>CIVN3001A</td>
<td>Construction Materials I</td>
<td>15</td>
<td>7</td>
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<tr>
<td>CIVN3004A</td>
<td>Geotechnical Engineering I</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>CIVN3010A</td>
<td>Structural Steel Design</td>
<td>15</td>
<td>7</td>
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<tr>
<td>CIVN3011A</td>
<td>Reinforced Concrete Design</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>CIVN3012A</td>
<td>Hydrology</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>CIVN3013A</td>
<td>Basic Hydraulics</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>CIVN3014A</td>
<td>Structural Engineering IA</td>
<td>15</td>
<td>7</td>
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<tr>
<td>CIVN3015A</td>
<td>Structural Engineering IB</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>CIVN3016A</td>
<td>Infrastructure Planning and Management</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>CIVN3017A</td>
<td>Systems Analysis and Optimisation</td>
<td>15</td>
<td>7</td>
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</table>

A student shall also complete the following course to the satisfaction of the Senate:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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</thead>
<tbody>
<tr>
<td>CIVN1999A</td>
<td>Vacation Work II (Civil)</td>
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7.7.3.4 **Fourth year of study**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>NQF</th>
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</thead>
<tbody>
<tr>
<td>CIVN4000A</td>
<td>Construction Materials II</td>
<td>21</td>
<td>8</td>
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</tbody>
</table>

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b) **Information Engineering (EFA04)**

- APPM3021A  Computational Mathematics (15) (NQF 7)
- ELEN3002A  Electronics II (15) (NQF 7)
- ELEN3007A  Probabilistic Systems Analysis (12) (NQF 7)
- ELEN3009A  Software Development II (18) (NQF 7)
- ELEN3012A  Signals and Systems IIA (12) (NQF 7)
- ELEN3013A  Signals and Systems IIB (9) (NQF 7)
- ELEN3015A  Data and Information Management (18) (NQF 7)
- ELEN3016A  Control I (18) (NQF 7)
- ELEN3017A  Electrical Engineering Design (15) (NQF 7)
- ELEN3018A  Economics of Design (12) (NQF 7)
- ELEN3024A  Communication Fundamentals (12) (NQF 7)

A student shall also complete the following course to the satisfaction of the Senate:

**ELEN1999A  Vacation Work II (Electrical)**

### 7.7.4.4 Fourth year of study

#### a) Electrical Engineering (EFA03)

The curriculum for the fourth year of study shall comprise eight courses consisting of five compulsory courses:

- ELEN4000A  Electrical Engineering Design II (24) (NQF 8)
- ELEN4002A  Electrical Engineering Laboratory (33) (NQF 8)
- ELEN4006A  Measurement Systems (15) (NQF 8)
- ELEN4019A  Selected Topics in Sociology (12) (NQF 8)
- MECN4020A  Systems Management and Integration (12) (NQF 8)

and three elective courses selected from the following as may be offered in any year:

- ELEN4001A  High Frequency Techniques (15) (NQF 8)
- ELEN4003A  High Voltage Engineering (15) (NQF 8)
- ELEN4009A  Software Engineering (15) (NQF 8)
- ELEN4010A  Software Development III (15) (NQF 8)
- ELEN4014A  Electromechanical Conversion (15) (NQF 8)
- ELEN4016A  Control II (15) (NQF 8)
- ELEN4018A  Power Systems (15) (NQF 8)

#### b) Information Engineering (EFA04)

The curriculum for the fourth year of study shall comprise eight courses consisting of five compulsory courses:

- ELEN4006A  Measurement Systems (15) (NQF 8)
- ELEN4011A  Information Engineering Design (24) (NQF 8)
- ELEN4012A  Information Engineering Laboratory (33) (NQF 8)
- ELEN4019A  Selected Topics in Sociology (12) (NQF 8)
- MECN4020A  Systems Management and Integration (12) (NQF 8)

and three elective courses selected from the following as may be offered in any year:

- ELEN4009A  Software Engineering (15) (NQF 8)
- ELEN4010A  Software Development III (15) (NQF 8)

---

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7.7.5 Branch of Industrial Engineering (EFA07)

7.7.5.1 First year of study

- CHEM1033A Chemistry I (Auxiliary) (15) (NQF 5)
- MATH1014A Mathematics I (30) (NQF 5)
- MECN1001A Introduction to Mechanical Engineering and Design (18) (NQF 5)
- MECN1003A Engineering Drawing (27) (NQF 5)
- PHYS1014A Physics IE (30) (NQF 5)
- PHYS1015A Mechanics (30) (NQF 5)

7.7.5.2 Second year of study

- ELEN2000A Electrical Engineering (18) (NQF 6)
- MATH2011A Mathematics II (27) (NQF 6)
- MECN2000A Fluid Mechanics I (12) (NQF 6)
- MECN2005A Mechanical Engineering Laboratory I (9) (NQF 6)
- MECN2006A Thermodynamics I (12) (NQF 6)
- MECN2010A Introduction to Materials Science and Engineering (12) (NQF 6)
- MECN2011A Applied Mechanics A (15) (NQF 6)
- MECN2012A Computing Skills and Software Development (15) (NQF 6)
- MECN2013A Applied Mechanics B (15) (NQF 6)
- MECN2014A Mechanical Engineering Design I (24) (NQF 6)

7.7.5.3 Third year of study

- MECN3004A Industrial Engineering Design (27) (NQF 7)
- MECN3006A Industrial Engineering Laboratory (15) (NQF 7)
- MECN3012A Mechatronics I (15) (NQF 7)
- MECN3013A Business Management (12) (NQF 7)
- MECN3014A Operations Management: Techniques (15) (NQF 7)
- MECN3025A Manufacturing Technology: Processes (12) (NQF 7)
- MECN3026A Principles of Organisational Behaviour (9) (NQF 7)
- MECN3028A Engineering in its Social Context (18) (NQF 7)
- MECN3030A Operations Research (15) (NQF 7)
- MECN3031A Mathematical Topics (Industrial) (18) (NQF 7) (Not to be taken by students articulating from EFA01)
- MATH3033A Mathematical Methods (Industrial) (7) (NQF 7)

Students articulating from EFA01 will be required to obtain 15 credits from the third year EFA01 curriculum subject to pre- and co-requisite requirements.

A student shall also complete the following course to the satisfaction of the Senate:

- MECN1998A Vacation Work I (Mechanical)

7.7.5.4 Fourth year of study

- MECN1004A Selected Topics in Social Science (12) (NQF 5)

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Rules for Engineering and the Built Environment

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MECN4005A Design Project (39) (NQF 8)
MECN4006A Research Project (39) (NQF 8)
MECN4009A Manufacturing Technology: Systems (15) (NQF 8)
MECN4015A Business Studies (12) (NQF 8)
MECN4020A Systems Management and Integration (12) (NQF 8)
MECN4028A Decision Support and Intelligence Systems (15) (NQF 8)
MECN4030A Operations Management: Systems Integration (15) (NQF 8)

A student shall also complete the following courses to the satisfaction of the Senate:
MECN1996A Engineering Professional Activity
MECN1999A Vacation Work II (Mechanical)

7.7.6 Branch of Mechanical Engineering (EFA05)

7.7.6.1 First year of study
CHEM1033A Chemistry I (Auxiliary) (15) (NQF 5)
MATH1014A Mathematics I (30) (NQF 5)
MECN1001A Introduction to Mechanical Engineering and Design (18) (NQF 5)
MECN1003A Engineering Drawing (27) (NQF 5)
PHYS1014A Physics IE (30) (NQF 5)
PHYS1015A Mechanics (30) (NQF 5)

7.7.6.2 Second year of study
ELEN2000A Electrical Engineering (18) (NQF 6)
MATH2011A Mathematics II (27) (NQF 6)
MECN2000A Fluid Mechanics I (12) (NQF 6)
MECN2005A Mechanical Engineering Laboratory I (9) (NQF 6)
MECN2006A Thermodynamics I (12) (NQF 6)
MECN2010A Introduction to Materials Science and Engineering (12) (NQF 6)
MECN2011A Applied Mechanics A (15) (NQF 6)
MECN2012A Computing Skills and Software Development (15) (NQF 6)
MECN2013A Applied Mechanics B (15) (NQF 6)
MECN2014A Mechanical Engineering Design I (24) (NQF 6)

7.7.6.3 Third year of study
MATH3026A Mathematical Methods (15) (NQF 7)
MECN3002A Fluid Mechanics II (12) (NQF 7)
MECN3007A Mechanical Engineering Laboratory II (15) (NQF 7)
MECN3010A Mechanics of Solids I (15) (NQF 7)
MECN3012A Mechatronics I (15) (NQF 7)
MECN3013A Business Management (12) (NQF 7)
MECN3017A Thermodynamics II (12) (NQF 7)
MECN3019A Mechanical Engineering Design and Production (30) (NQF 7)
MECN3027A Mechanical Vibrations (15) (NQF 7)
MECN3028A Engineering in its Social Context (18) (NQF 7)
MECN3032A Numerical Methods and Statistics (18) (NQF 7)
A student shall also complete the following course to the satisfaction of the Senate:

**MECN1998A** Vacation Work I (Mechanical)

### 7.7.6.4 Fourth year of study

- **MECN1004A** Selected Topics in Social Science (12) (NQF 5)
- **MECN4005A** Design Project (39) (NQF 8)
- **MECN4006A** Research Project (39) (NQF 8)
- **MECN4013A** Thermal Systems (15) (NQF 8)
- **MECN4020A** Systems Management and Integration (12) (NQF 8)
- **MECN4021A** Fluid Dynamics (15) (NQF 8)
- **MECN4023A** Mechanics of Solids II (15) (NQF 8)
- **MECN4029A** Mechatronics II (15) (NQF 8)

A student shall also complete the following courses to the satisfaction of the Senate:

- **MECN1996A** Engineering Professional Activity
- **MECN1999A** Vacation Work II (Mechanical)

### 7.7.7 Branch of Metallurgy and Materials Engineering (EFA08)

#### 7.7.7.1 First year of study

- **CHEM1031A** Chemistry I (33) (NQF 5)
- **CHMT1002A** Introduction to Process and Materials Engineering (30) (NQF 5)
- **MATH1014A** Mathematics I (30) (NQF 5)
- **PHYS1025A** Physics (30) (NQF 5)

A student shall also complete the following courses, the marks of which may be averaged for the purpose of progression:

- **ELEN1003A** Critical Thinking (12) (NQF 5)
- **HIST1010A** A Social History of Technology (9) (NQF 5)

#### 7.7.7.2 Second year of study

- **CHEM2018A** Chemistry II (Metallurgy) (12) (NQF 6)
- **CHMT2009A** Introductory Mineralogy and Earth Sciences (9) (NQF 6)
- **CHMT2011A** Computing for Process Engineering (15) (NQF 6)
- **CHMT2017A** Introduction to Extractive Metallurgy (15) (NQF 6)
- **CHMT2018A** Practical Metallurgy (12) (NQF 6)
- **CHMT2019A** Materials Science and Engineering (15) (NQF 6)
- **ELEN2000A** Electrical Engineering (18) (NQF 6)
- **MATH2012A** Mathematics II (15) (NQF 6)

A student shall also complete the following course:

- **ECON1002A** Economic Concepts 1A (18) (NQF 5)

A student shall also complete the following courses to the satisfaction of the Senate:

- **CHMT1997A** Practical Training (Metallurgy and Materials Engineering)
- **CHMT1998A** Vacation Work I (Metallurgy and Materials Engineering)

#### 7.7.7.3 Third year of study

- **CHMT3009A** Metallurgical Thermodynamics (24) (NQF 7)

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### Rules for Engineering and the Built Environment

**Note:** 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
<th>Qualification Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMT3014A</td>
<td>Engineering Failure Analysis (9) (NQF 7)</td>
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<tr>
<td>CHMT3016A</td>
<td>Applied Mathematics Topics (18) (NQF 7)</td>
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<tr>
<td>CHMT3019A</td>
<td>Kinetics and Transport Processes in Metallurgical Engineering (15) (NQF 7)</td>
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<tr>
<td>CHMT3021A</td>
<td>Solidification, Heat Treatment and Microstructure (15) (NQF 7)</td>
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<td></td>
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<tr>
<td>CHMT3024A</td>
<td>Environmental Process Engineering (9) (NQF 7)</td>
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<tr>
<td>CHMT3025A</td>
<td>Crystal Structure and Analysis (12) (NQF 7)</td>
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</tr>
<tr>
<td>CHMT3026A</td>
<td>Process and Materials Design (21) (NQF 7)</td>
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<tr>
<td>CHMT3027A</td>
<td>Corrosion and Wear (15) (NQF 7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHMT3028A</td>
<td>Non-Ferrous Pyrometallurgy (12) (NQF 7)</td>
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<td></td>
<td>A student shall also complete the following course to the satisfaction of the Senate:</td>
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<tr>
<td></td>
<td>CHMT1999A Vacation Work II (Metallurgy and Materials Engineering)</td>
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#### 7.7.7.4 Fourth year of study

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
<th>Qualification Level</th>
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<tbody>
<tr>
<td>CHMT4002A</td>
<td>Physical Chemistry of Iron and Steel Manufacturing (12) (NQF 8)</td>
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<tr>
<td>CHMT4003A</td>
<td>Metallurgical Design (30) (NQF 8)</td>
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<td>CHMT4004A</td>
<td>Research Project (30) (NQF 8)</td>
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<td>CHMT4005A</td>
<td>Management for Process Engineers (12) (NQF 8)</td>
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<tr>
<td>CHMT4008A</td>
<td>Particulate Systems (12) (NQF 8)</td>
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<td>CHMT4011A</td>
<td>Process Control (12) (NQF 8)</td>
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<tr>
<td>CHMT4015A</td>
<td>Welding and Forming Processes (9) (NQF 8)</td>
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<tr>
<td>CHMT4020A</td>
<td>Hydrometallurgical Processes (12) (NQF 8)</td>
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</table>

#### 7.7.7.8 Branch of Mining Engineering (EFA09)

#### 7.7.8.1 First year of study

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
<th>Qualification Level</th>
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</thead>
<tbody>
<tr>
<td>CHEM1033A</td>
<td>Chemistry I (Auxiliary) (15) (NQF 5)</td>
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<tr>
<td>MATH1014A</td>
<td>Mathematics I (30) (NQF 5)</td>
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<tr>
<td>MINN1000A</td>
<td>Mining Graphics and Design (21) (NQF 5)</td>
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</tr>
<tr>
<td>MINN1001A</td>
<td>Engineering Skills (Mining) (15) (NQF 5)</td>
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<tr>
<td>PHYS1014A</td>
<td>Physics IE (30) (NQF 5)</td>
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<tr>
<td>PHYS1015A</td>
<td>Mechanics (30) (NQF 5)</td>
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<td>A student shall also complete the following course to the satisfaction of the Senate:</td>
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<tr>
<td></td>
<td>MINN1997A Practical Training (Mining)</td>
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</table>

#### 7.7.8.2 Second year of study

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
<th>Qualification Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPM2014A</td>
<td>Applied Mathematics II A (18) (NQF 6)</td>
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<tr>
<td>ELEN2000A</td>
<td>Electrical Engineering (18) (NQF 6)</td>
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<tr>
<td>GEOL1001A</td>
<td>Geology IA (15) (NQF 6)</td>
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<tr>
<td>GEOL1002A</td>
<td>Geology IB (15) (NQF 6)</td>
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<td></td>
</tr>
<tr>
<td>MATH2012A</td>
<td>Mathematics II (15) (NQF 6)</td>
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<td></td>
</tr>
<tr>
<td>MINN2000A</td>
<td>Computer Applications in Mining (21) (NQF 6)</td>
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<td></td>
</tr>
<tr>
<td>MINN2001A</td>
<td>Excavation Engineering (27) (NQF 6)</td>
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</tr>
<tr>
<td>MINN2004A</td>
<td>Engineering Surveying (21) (NQF 6)</td>
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</tr>
<tr>
<td></td>
<td>A student shall also complete the following course to the satisfaction of the Senate:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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MINN3011A Mine Ventilation and Climate Control (15) (NQF 7)
MINN3012A Mine Surveying (21) (NQF 7)
MINN3014A Health, Safety and the Mining Environment (15) (NQF 7)
A student shall also complete the following course to the satisfaction of the Senate:
MINN1998A Vacation Work I (Mining)

(b) Fourth year of study
MINN4000A Mine Management Principles (12) (NQF 8)
MINN4001A Mine Management Techniques (12) (NQF 8)
MINN4002A Industrial and Research Seminars II (12) (NQF 8)
MINN4003A Mining B (15) (NQF 8)
MINN4004A Mining C (15) (NQF 8)
MINN4005A Financial Valuation (18) (NQF 8)
MINN4006A Mine Design (21) (NQF 8)
MINN4007A Project Report (15) (NQF 8)
MINN4008A Mining D (15) (NQF 8)
MINN4009A Mining E (15) (NQF 8)
MINN4010A Rock Engineering (18) (NQF 8)
A student shall also complete the following course to the satisfaction of the Senate:
MINN1999A Vacation Work II (Mining)

7.9 Bachelor of Science in Property Studies (FF004)

7.9.1 Restriction on admission to courses: prerequisite requirements
A student shall not be admitted to courses listed under A below unless s/he has obtained credit in or been exempted from the courses listed under B below:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT1000 Business Statistics</td>
<td>MATH1039 Mathematics for Property Studies</td>
</tr>
<tr>
<td>BUQS2009 Econometrics for Property Studies</td>
<td>MATH1039 Mathematics for Property Studies and STAT1000 Statistics for Business</td>
</tr>
<tr>
<td>BUQS2014 Real Estate Corporate Finance</td>
<td>BUQS1009 Real Estate Principles and MATH1039 Mathematics for Property Studies</td>
</tr>
<tr>
<td>BUQS2011 Real Estate Market Analysis</td>
<td>BUQS2011 Real Estate Market Analysis and BUQS2014 Real Estate Corporate Finance</td>
</tr>
<tr>
<td>BUQS2012 Real Estate Law</td>
<td>LAWS1000 Commercial Law</td>
</tr>
<tr>
<td>BUQS2013 Urban Economics</td>
<td>ECON1008/ECON1012 Economics IA and ECON1009/ECON1013 Economics IB and ARPL1010 Planning for Property Developers</td>
</tr>
<tr>
<td>BUQS3021 Real Estate Management</td>
<td>BUQS2011 Real Estate Market Analysis and BUQS2014 Real Estate Corporate Finance</td>
</tr>
<tr>
<td>BUQS3022 Real Estate Valuation</td>
<td>BUQS2011 Real Estate Market Analysis and BUQS2014 Real Estate Corporate Finance</td>
</tr>
</tbody>
</table>

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### Courses

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUQS3023 Real Estate Finance</td>
<td>BUQS2014 Real Estate Corporate Finance</td>
</tr>
<tr>
<td>BUQS3011 Professional and Research Skills</td>
<td>BUQS2009 Econometrics for Property Studies</td>
</tr>
<tr>
<td>BUQS3027 Building Technology II</td>
<td>BUQS1006 Construction Technology I or BUQS2015 Building Technology I</td>
</tr>
<tr>
<td>BUQS4033 Entrepreneurship and Innovation</td>
<td>BUQS4035 Management and Leadership in the Property Sector</td>
</tr>
<tr>
<td>BUQS4034 Advanced Real Estate Valuation</td>
<td>BUQS3022 Real Estate Valuation</td>
</tr>
<tr>
<td>BUQS4036 Commercial Real Estate Investments</td>
<td>BUQS3023 Real Estate Finance and</td>
</tr>
<tr>
<td>BUQS4037 Corporate Real Estate</td>
<td>BUQS3021 Real Estate Management</td>
</tr>
<tr>
<td>BUQS4038 Real Estate Development</td>
<td>BUQS2011 Real Estate Market Analysis, BUQS3023 Real Estate Finance and BUQS3024 Environmental Impact Assessment</td>
</tr>
<tr>
<td>BUQS4039 Facilities Management</td>
<td>BUQS2003 Building Science I or BUQS3026 Building Services, BUQS2004 Construction Technology II or BUQS3027 Building Technology II and BUQS3021 Real Estate Management</td>
</tr>
<tr>
<td>BUQS4041 Research Report</td>
<td>BUQS3011 Professional and Research Skills</td>
</tr>
</tbody>
</table>

### Study Years

#### 7.9.2 First year of study
- **ARPL1010** Planning for Property Developers (18) (NQF 5)
- **BUQS1007** Communication Skills (18) (NQF 5)
- **BUQS1009** Real Estate Principles (18) (NQF 5)
- **ECON1012** Economics IA – Microeconomics (18) (NQF 5)
- **ECON1014** Economics IB – Macroeconomics (18) (NQF 5)
- **LAWS1000** Commercial Law (18) (NQF 5)
- **MATH1039** Mathematics for Property Studies (18) (NQF 5)
- **STAT1000** Business Statistics (18) (NQF 5)

#### 7.9.3 Second year of study
- **BUQS2015** Building Technology I (18) (NQF 6)
- **BUQS2008** Accounting Principles for Construction (18) (NQF 6)
- **BUQS2009** Econometrics for Property Studies (18) (NQF 6)
- **BUQS2011** Real Estate Market Analysis (18) (NQF 6)
- **BUQS2012** Real Estate Law (18) (NQF 6)
- **BUQS2013** Urban Economics (18) (NQF 6)
- **BUQS2014** Real Estate Corporate Finance (36) (NQF 6)

#### 7.9.4 Third year of study

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7.9.5 Fourth year of study

The curriculum for the fourth year of study shall comprise of eight courses consisting of six compulsory courses:

- BUQS4033 Entrepreneurship and Innovation (18) (NQF 8)
- BUQS4034 Advanced Real Estate Evaluation (18) (NQF 8)
- BUQS4035 Management and Leadership in the Property Sector (18) (NQF 8)
- BUQS4036 Commercial Real Estate Investments (18) (NQF 8)
- BUQS4040 Advanced Real Estate Market Analysis (18) (NQF 8)
- BUQS4041 Research Report (36) (NQF 8)

and two elective courses selected from the following courses as may be offered in any year:

- BUQS4037 Corporate Real Estate (18) (NQF 8)
- BUQS4038 Real Estate Development (18) (NQF 8)
- BUQS4039 Facilities Management (18) (NQF 8)

7.10 Quantity Surveying

7.10.1 Bachelor of Science with Honours in Quantity Surveying (FH006)

- BUQS4022 Simulated Project (18) (NQF 8)
- BUQS4023 Dispute Resolution (18) (NQF 8)
- BUQS4024 Cost Evaluation and Control (18) (NQF 8)
- BUQS4025 Advanced Theory and Practice of Quantity Surveying IV (18) (NQF 8)
- BUQS4026 Construction Law (18) (NQF 8)
- BUQS4027 Construction Project Management (18) (NQF 8)
- BUQS4031 Research Report (39) (NQF 8)

A student shall also complete the following course to the satisfaction of the Senate:

- BUQS1991 Practical Training

7.11 Bachelor of Science in Urban and Regional Planning

7.11.1 Bachelor of Science in Urban and Regional Planning (FBA05)

7.11.1.1 Restriction on admission to courses: prerequisite requirements

A student shall not be admitted to courses listed in the table under A unless s/he has obtained credit in or been exempted from the courses listed under B:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARPL2015A Contemporary Design and Environmental Issues in South Africa</td>
<td>ARPL1016A Introduction to Settlement Form and Design and</td>
</tr>
</tbody>
</table>

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
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<tbody>
<tr>
<td>CIVN1005A Introduction to Civil Engineering Infrastructure</td>
<td>ARPL1014A Settlements through History</td>
</tr>
<tr>
<td>ARPL2006A Planning for Housing Services, Infrastructure and Transport</td>
<td>APPM1023A Mathematical Techniques for Planners</td>
</tr>
<tr>
<td>ARPL3027A Regional Planning and Local Economic Development</td>
<td>ECON1002A Economic Concepts IA and ECON1003A Economic Concepts IB</td>
</tr>
<tr>
<td>ARPL3012A Comparative Approaches to Urban Design</td>
<td>ARPL2015A Contemporary Design and Environmental Issues in South Africa</td>
</tr>
<tr>
<td>BUQS2013A Urban Economics</td>
<td>ECON1002A Economic Concepts IA and ECON1003A Economic Concepts IB</td>
</tr>
<tr>
<td>ARPL3013A Housing Theory, Law and Policy</td>
<td>ARPL2006A Planning for Housing Services, Infrastructure and Transport</td>
</tr>
<tr>
<td>ARPL3026A Integrated Development Planning</td>
<td>ARPL2006A Planning for Housing Services, Infrastructure and Transport</td>
</tr>
<tr>
<td>ARPL3030A Applications in Graphic and Spatial Communication in Planning</td>
<td>ARPL2015A Contemporary Design and Environmental Issues in South Africa</td>
</tr>
<tr>
<td>ARPL3029A Spatial and Design Principles</td>
<td>ARPL2015A Contemporary Design and Environmental Issues in South Africa</td>
</tr>
</tbody>
</table>

### 7.11.1.2 First year of study

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPM1023A Mathematical Techniques for Planners</td>
<td>18</td>
<td>NQF 5</td>
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<tr>
<td>ARPL1014A Settlements Through History</td>
<td>12</td>
<td>NQF 5</td>
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<tr>
<td>ARPL1015A Introduction to Environmental Interpretation</td>
<td>24</td>
<td>NQF 5</td>
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<tr>
<td>ARPL1016A Introduction to Settlement Form and Design</td>
<td>24</td>
<td>NQF 5</td>
</tr>
<tr>
<td>GEOG1003A Geography for Planners</td>
<td>24</td>
<td>NQF 5</td>
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<tr>
<td>ARPL1026A Identity and Society I</td>
<td>18</td>
<td>NQF 5</td>
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### 7.11.1.3 Second year of study

<table>
<thead>
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<th>Credits</th>
<th>Qualification</th>
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<tbody>
<tr>
<td>ARPL1025A Two and Three Dimensional Computer Aided Design and GIS</td>
<td>12</td>
<td>NQF 6</td>
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<tr>
<td>ARPL2006A Planning for Housing Services, Infrastructure and Transport</td>
<td>12</td>
<td>NQF 6</td>
</tr>
<tr>
<td>ARPL2013A Introduction to Land Management</td>
<td>18</td>
<td>NQF 6</td>
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<tr>
<td>ARPL2015A Contemporary Design and Environmental Issues in South Africa</td>
<td>18</td>
<td>NQF 6</td>
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<tr>
<td>ARPL2017A Histories, Theories and Futures of Planning</td>
<td>12</td>
<td>NQF 6</td>
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</tbody>
</table>

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7.11.1.4 Third year of study

The following courses are prescribed for all students in the third year of study:

- **APPM3036A** Quantitative Methods for Planners (12) (NQF 7)
- **ARPL3010A** Comparative Planning Systems (12) (NQF 7)
- **ARPL3026A** Integrated Development Planning (18) (NQF 7)
- **ARPL3027A** Regional Planning and Local Economic Development (12) (NQF 7)
- **ARPL3028A** Development Policy and Processes in South Africa (12) (NQF 7)
- **ARPL3030A** Applications in Graphic and Spatial Communication in Planning (12) (NQF 7)
- **BUQS2013A** Urban Economics (18) (NQF 7)

In the third year of study students shall be required to choose one of three possible specialisations to a minimum of 42 and maximum 48 credits:

a) Urban design;

b) Housing;

c) Urban politics;

In special circumstances, the Senate may approve other course combinations for the three specialisations or, any other specialisation yielding a minimum of 42 and maximum of 48 credits;

Or, may approve the offering of another specialisation with any combination of existing courses yielding a minimum of 42 and maximum of 48 credits.

A student shall be required to select one of the following specialisations and obtain a total of at least 360 credits for the degree.

**Urban Environmental Design**, for which the courses are:

- **ARPL3012A** Comparative Approaches to Urban Design (24) (NQF 7) (also considered relevant for the Housing specialisation)

and

- **ARPL3029A** Spatial and Design Principles (18) (NQF 7) or any other third year level course yielding 18 credits, considered by the Senate to be appropriate or

**Housing**, for which the courses are:

- **ARPL3013A** Housing Theory, Law and Policy (24) (NQF 7)

and

any other courses adding up to at least 18 credits considered by the Senate to be appropriate to the study of Planning that are related to Housing or

**Urban Politics and Governance**, for which the courses are:

- **ARPL3023A** Politics, Governance and the City (24) (NQF 7) (also considered relevant for the Housing specialisation)

and

- **POLS3017A** Liberty, Justice and the Politics of Difference (18) (NQF 7)

---

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
or any other third year level 18 credit course considered by the Senate to be appropriate.

7.11.2 Condoned pass in selected courses
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%, but pass the second semester well enough that the total mark of the courses in the two semesters is over 50%, may receive a condoned pass for the course in the first semester:

a) ARPL1015A - Introduction to Environmental Interpretation, and
b) ARPL1016A - Introduction to Settlement Form and Design.

7.11.3 Repeating and substituting courses
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.

7.12 Bachelor of Science with Honours in Urban and Regional Planning

7.12.1 Bachelor of Science with Honours in Urban and Regional Planning (FHA04)

7.12.1.1 Curriculum
The following courses are prescribed:

ARPL4014A Advanced Planning Thought (20) (NQF 8)
ARPL4026A Planning Law and Professional Practice and Ethics (30) (NQF 8)
ARPL4027A Integrated Planning Project (30) (NQF 8)
ARPL4028A Research Design for Planners (10) (NQF 8)
ARPL4029A Research Report (60) (NQF 8)

Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other honours courses relevant to the field of planning.

7.12.1.2 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% of the credits yielded by the coursework requirements of the degree.

7.12.1.3 Repeating and substituting courses
A candidate who fails any course/s may be permitted to repeat such course/s, or with special permission of the Senate substitute another course/s for the courses that the candidate has failed.

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

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. Qualification includes any degree, diploma, certicate, licentiate, or any other educational attainment that is offered by the University as stipulated in its list of qualifications.
7.13 Bachelor of Science in Construction Studies (FBA04)

7.13.1 Restriction on admission to courses: prerequisite requirements

A student shall not be admitted to courses listed under A below unless s/he has obtained credit in or been exempted from the courses listed under B:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIVN2012A Civil Engineering</td>
<td>MATH1038A Mathematics and</td>
</tr>
<tr>
<td>Theory I</td>
<td>PHYS1025A Physics</td>
</tr>
<tr>
<td>CIVN3019A Civil Engineering</td>
<td>CIVN2012A Civil Engineering</td>
</tr>
<tr>
<td>II (CS)</td>
<td>Theory I</td>
</tr>
<tr>
<td>BUQS2003A Building Science I</td>
<td>PHYS1025A Physics</td>
</tr>
<tr>
<td>BUQS2004A Construction</td>
<td>BUQS1006A Construction</td>
</tr>
<tr>
<td>Technology II</td>
<td>Technology I</td>
</tr>
<tr>
<td>BUQS2005A Quantities and</td>
<td>BUQS1008A Quantities and</td>
</tr>
<tr>
<td>Specifications II</td>
<td>Specifications I</td>
</tr>
<tr>
<td>BUQS3011A Professional and</td>
<td>BUQS1007A Communication Skills</td>
</tr>
<tr>
<td>Research Skills</td>
<td></td>
</tr>
<tr>
<td>BUQS3012A Quantities and</td>
<td>BUQS2005A Quantities and</td>
</tr>
<tr>
<td>Specifications III</td>
<td>Specifications II</td>
</tr>
<tr>
<td>BUQS3013A Construction</td>
<td>BUQS2004A Construction</td>
</tr>
<tr>
<td>Technology III</td>
<td>Technology II</td>
</tr>
<tr>
<td>BUQS3016A Building Science II</td>
<td>BUQS2003A Building Science I</td>
</tr>
</tbody>
</table>

7.13.2 First year of study

APPM1022A Introductory Statistics for Construction (18) (NQF 5)
BUQS1004A Construction Drawings (12) (NQF 5)
BUQS1005A Construction Materials and Environment (12) (NQF 5)
BUQS1006A Construction Technology I (12) (NQF 5)
BUQS1007A Communication Skills (12) (NQF 5)
BUQS1008A Quantities and Specifications I (12) (NQF 5)
LAWS1000A Commercial Law I (18) (NQF 5)
MATH1038A Mathematics (18) (NQF 5)
PHYS1025A Physics (30) (NQF 5)
A student shall also complete the following course to the satisfaction of the Senate:
BUQS1992A Practical Experience I

7.13.3 Second year of study

BUQS2003A Building Science I (12) (NQF 6)
BUQS2004A Construction Technology II (12) (NQF 6)
BUQS2005A Quantities and Specifications II (12) (NQF 6)
BUQS2006A Site Management (12) (NQF 6)
BUQS2008A Accounting Principles in Construction (18) (NQF 6)
CIVN2012A Civil Engineering Theory I (CS) (18) (NQF 6)
ECON1012A Economics IA - Microeconomics (18) (NQF 5)
ECON1014A Economics IB - Macroeconomics (18) (NQF 5)
MINN2004A Engineering Surveying (21) (NQF 6)
A student shall also complete the following course to the satisfaction of the Senate:
BUQS1993A Practical Experience II

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
7.13.4 Third year of study

- BUQS3011A  Professional and Research Skills (12) (NQF 7)
- BUQS3012A  Quantities and Specifications III (12) (NQF 7)
- BUQS3013A  Construction Technology III (12) (NQF 7)
- BUQS3014A  Estimating and Analysis of Prices (18) (NQF 7)
- BUQS3015A  Management Principles in Construction (12) (NQF 7)
- BUQS3016A  Building Science II (12) (NQF 7)
- BUQS3018A  Introduction to Construction Management (12) (NQF 7)
- BUQS3020A  Property Studies (12) (NQF 7)
- CIVN3019A  Civil Engineering II (CS) (18) (NQF 7)
- LAWS2007A  Business Enterprise Law (24) (NQF 6)

A student shall also complete the following course to the satisfaction of the Senate:
- BUQS1994A  Practical Experience III

**Awards of Master**

**P10 METHODS BY WHICH THE MASTERS QUALIFICATIONS MAY BE ATTAINED**

<table>
<thead>
<tr>
<th>Research</th>
<th>Coursework and Research Report</th>
<th>Coursework</th>
</tr>
</thead>
<tbody>
<tr>
<td>MArch (FRA00)</td>
<td>MArch (Professional) (FCA02) MArch (FCA12)</td>
<td></td>
</tr>
<tr>
<td>MSc(QS) (FRA01)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSc(URP) (FRA02)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSc(Building) (FRA03)</td>
<td>MSc(Building) (FCA11)</td>
<td></td>
</tr>
<tr>
<td>MSc(Engine) (ERA00)</td>
<td>MSc(Engine) (ECA00)</td>
<td>MEng (EC001)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSc in Aeronautical Engineering (ECA02)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSc in Engineering Management (ECA04)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSc in Industrial Engineering (ECA06)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSc in Mechanical Engineering (ECA05)</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Research</th>
<th>Coursework and Research Report</th>
<th>Coursework</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MSc in Systems Engineering</td>
<td>(ECA07)</td>
</tr>
<tr>
<td></td>
<td>MSc in Bulk Materials Handling</td>
<td>(ECA03)</td>
</tr>
</tbody>
</table>

P11 RULES APPLICABLE TO MASTERS

11.1 Research in organisations outside the University

The Senate may permit a candidate to conduct advanced study and research in terms of P13, or undertake her/his Research Report in terms of P14, at an institution outside the University which has been specially recognised by the Senate for this purpose.

11.2 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.

11.3 Further assessment

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

P12 ADMISSION TO CANDIDATURE

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 G4.11.1, G4.11.4 and G4.11.6 a candidate with the qualifications listed in P12.1 – P12.11 may be admitted to candidature for the appropriate qualification of master.

12.1 Master of Architecture (Professional)

BAS(Hons) of this University or the equivalent.

12.2 Master of Architecture

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

12.3 Master of Architecture in the field of Sustainable and Energy Efficient Cities

a) Honours or the equivalent; and
b) A minimum of 2 years work experience post qualification.

12.4 Master of the Built Environment in the field of Housing

See G4.11.1, G4.11.4 and G4.11.6.

12.5 Master of Science in Building

a) BSc(Building) or BSc(Construction Management) or BSc Hons(Construction Management of this University or the equivalent;
b) BArch or BSc(TRP) or BSc (Hons) (URP), or MArch(Prof) or BSc(Property Studies), or BSc(QS) or BSc Hons(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.

12.6 **Master of Science in Development Planning**

a) A BSc (URP) (Hons) at a sufficient standard or the equivalent;

b) PGDip (Planning) with an average of at least 60%.

12.7 **Master of Science in Engineering/Master of Engineering**

a) BSc(Eng) of this University or the equivalent;

b) PGDip in Engineering of this University or the equivalent;

c) BSc with Honours or a BSc(TRP) or BSc (Hons)(URP), or BSc(Building) or BSc Hons(Construction Management or a BSc(QS) or BSc Hons(Quantity Surveying), of this University or the equivalent;

d) In exceptional circumstances and with special permission of the Senate, another Honours degree of this University or any other university.

12.8 **Master of Science in Urban and Regional Planning**

a) BSc(TRP) or BSc (Hons)(URP) 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.

12.9 **Master of Science in Quantity Surveying**

BSc(QS) or BSc Hons(Quantity Surveying) of this University or the equivalent.

12.10 **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(TRP) or BSc (Hons)(URP) of this University or the equivalent;

e) A person who has in any other manner satisfied the Senate that s/he is so qualified.

12.11 **Master of Urban Studies**

a) BSc(TRP) or BSc (Hons)(URP) 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.

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12.12 **Master of Science in Aeronautical Engineering, Master of Science in Engineering Management, Master of Science in Industrial Engineering, Master of Science in Mechanical Engineering, Master of Science in Systems Engineering and Master of Science in Bulk Materials Handling**

a) BSc(Eng) of this University or the equivalent;
b) PGDip in Engineering of this University or the equivalent;
c) BSc with Honours or a BSc(TRA) or BSc (Hons)(URP), or BSc(Building) or BSc Honours(Construction Management or a BSc(QS) or BSc Honours(Quantity Surveying) of this University or the equivalent;
d) In exceptional circumstances and with special permission of the Senate, another Honours degree of this University or any other university.

**P13 MASTER BY RESEARCH**

See Rule G9.1- G 9.4

**P14 MASTER BY COURSEWORK AND RESEARCH REPORT**

**14.1 Length of Curriculum**

The length of the *curriculum* extends over no fewer than the number of academic years indicated in table 14.1.

<table>
<thead>
<tr>
<th></th>
<th>MArch (Prof)</th>
<th>MUD</th>
<th>MSc (Building)</th>
<th>MBE (Housing)</th>
<th>MSc(DP)</th>
<th>MArch (SEEC)</th>
<th>MUS</th>
<th>MSc(Eng)</th>
<th>MEng (course work only)</th>
<th>MSc</th>
</tr>
</thead>
<tbody>
<tr>
<td>1f/t or 2p/t</td>
<td>1f/t or 2p/t</td>
<td>1f/t</td>
<td>1f/t or 2p/t</td>
<td>1f/t or 2p/t</td>
<td>1f/t or 2p/t</td>
<td>1f/t or 2p/t</td>
<td>1f/t or 2p/t</td>
<td>1f/t or 2p/t</td>
<td>1f/t or 2p/t</td>
<td>1f/t or 2p/t</td>
</tr>
</tbody>
</table>

**14.2 Requirements for the qualification of Master by coursework and Research Report**

For all the qualifications listed in P14.1 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.

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*Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.*
14.3 Master of Science in Building

Master of Science in Building (FCA11)

14.3.1 A candidate may proceed in either of the specialised fields of Project Management in Construction or Property Development and Management.

14.3.2 The curriculum of a candidate must be approved by the Senate and must comprise a programme of courses totalling 180 credits.

14.3.3 For the purposes of these rules, the Research Report in 14.3.16(b) and 14.3.17(b) 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.

14.3.4 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.

14.3.5 Curriculum for specialised field of Project Management in Construction

a) BUQS7009A Research Methodology (20) (NQF 9)
BUQS7022A Construction Law and Contract Management (20) (NQF 9)
BUQS7024A Project Management (20) (NQF 9)
BUQS7025A Construction Planning and Control (20) (NQF 9)
BUQS7026A Construction Economics and Finance (20) (NQF 9)
BUQS7037A Construction Safety and Quality Management (20) (NQF 9)

b) Research Report
BUQS7027A Research Report in the field of Project Management in Construction (60) (NQF 9)

14.3.6 Curriculum for specialised field of Property Development and Management

a) BUQS7009A Research Methodology (20) (NQF 9)
BUQS7028A Real Estate Finance (10) (NQF 9)
BUQS7029A Real Estate Development (10) (NQF 9)
BUQS7030A Real Estate Market Analysis (10) (NQF 9)
BUQS7031A Real Estate Law (10) (NQF 9)
BUQS7032A Property Valuation (10) (NQF 9)
BUQS7033A Applied Macroeconomics (10) (NQF 9)
BUQS7034A Advanced Topics in Real Estate Studies (10) (NQF 9)
BUQS7035A Commercial Real Estate Investments (10) (NQF 9)
BUQS7036A Quantitative Methods for Property Studies (20) (NQF 9)

b) Research Report
BUQS7027A Research Report in the field of Property Development and Management (60) (NQF 9)

14.3.7 Completion and repetition of courses

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 totalling 80 credits or more her/his registration for the degree may be cancelled, unless the Senate is satisfied that there are exceptional circumstances.

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
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.

### 14.4 Master of Science in Development Planning

#### 14.4.1 MSc(DP) (FC015)

#### 14.4.1.1 Conditions for the award of degree

For the award of the Master of Science in Development Planning candidates are required to pass courses included in the *curriculum* totalling at least 180 credits.

#### 14.4.1.2 Curriculum

a) The following courses are prescribed:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARPL7029</td>
<td>Philosophies, Theories and Methodologies of Development Planning</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>ARPL7063</td>
<td>Governance and Municipal Planning</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>ARPL7044</td>
<td>Community Participation in Urban Governance: Discourses, Theories and Practices</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>ARPL7040</td>
<td>Research Methods</td>
<td>10</td>
<td>9</td>
</tr>
</tbody>
</table>

Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more Masters courses relevant to the field of Development Planning.

b) Subject to the approval of the Senate, a candidate must select an elective course that is at the level of master at this University and which is relevant to the field of Development Planning, for an equivalent minimum of 20 credits.

c) A candidate must successfully complete a Research Report (ARPL7064) yielding 90 credits at NQF level 9 on a topic appropriate to the field of Development Planning.

d) In exceptional circumstances, a candidate, who in the opinion of the Senate, lacks the necessary skills relating to development planning which are covered in the Postgraduate Diploma(Planning) may be required to complete up to three courses from the Postgraduate Diploma (Planning).

#### 14.4.1.3 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.

### 14.5 Master of Science in Engineering (ECA00)

#### 14.5.1 Curricula

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 totalling of 180 credits:

a) Coursework totalling 90 credits:

   i) A combination of four courses yielding 20 credits each and one course yielding 10 credits; or

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*Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.*
ii) Five courses yielding 20 credits each; and
b) A Research Report yielding 90 credits.
A candidate may be required in terms of G4.11.4 to register for undergraduate courses, for which no credit shall be obtained.
The Research Report must have a value of 90 credits and 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.

14.5.2 Branches offered:
The Master of Science in Engineering (by coursework and Research Report) is offered in the following branches or fields within a branch:

14.5.2.1 Branch of Chemical Engineering

14.5.2.1.1 In the field of Advanced Chemical Engineering
a) A combination of courses listed below, totalling 80 credits:
   CHMT7035A Process Flow Sheet Synthesis (20) (NQF 9)
   CHMT7036A Reactor Synthesis (20) (NQF 9)
   CHMT7037A Distillation Synthesis (20) (NQF 9)
   CHMT7038A Applied Thermodynamics (20) (NQF 9)
   CHMT7039A Applied Optimisation (20) (NQF 9)
   CHMT7040A Experimental Process Synthesis (20) (NQF 9)
   CHMT7072A Advanced Biochemical Engineering (20) (NQF 9)

b) Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other Masters courses relevant to the field of study.
c) Successfully complete a Research Methods in Engineering/Research Methodology course yielding a minimum of 10 credits at NQF level 9 and Research Report (CHMT7008A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.1.2 In the field of Petroleum, Oil and Gas Engineering
a) A combination of courses listed below, totalling 80 credits:
   CHMT7070A Nanotechnology in Petroleum Reservoir (20) (NQF 9)
   CHMT7062A The Future of the Automotive Industry and Fuels (20) (NQF 9)
   CHMT7063A Process Instrumentation and Control in Refining (20) (NQF 9)
   CHMT7064A Introduction to Oil and Gas Production Corrosion Mechanism (20) (NQF 9)
   CHMT7065A Oil Products and Refining (20) (NQF 9)
   CHMT7066A Introduction to Oil and Gas Offshore Platforms/Pipelines (20) (NQF 9)

b) Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other Masters courses relevant to the field of study.
c) Successfully complete a Research Methods in Engineering/Research Methodology course yielding a minimum of 10 credits at NQF level 9 and Research Report (CHMT7008A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.1.3 In the field of Coal Science and Technology
a) A combination of courses listed below, totalling 80 credits:
   CHMT7005A Coal Sampling and Quality Assessment (20) (NQF 9)
   CHMT7006A Coal Management and Marketing (20) (NQF 9)

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
CHMT7057A Coal Combustion and Power Generation (20) (NQF 9)
CHMT7058A Coal Preparation and Beneficiation (20) (NQF 9)
CHMT7059A Coal Conversion and Gasification (20) (NQF 9)
CHMT7060A Coal and Carbon in the Metallurgical Industry (20) (NQF 9)
CHMT7068A Underground Coal Gasification (20) (NQF 9)
CHMT7069A Carbon Capture in Power Plants (20) (NQF 9)

b) Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other Masters courses relevant to the field of study.

c) Successfully complete Research Methods in Engineering/Research Methodology course yielding a minimum of 10 credits at NQF level 9 and Research Report (CHMT7008A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.2 Branch of Civil Engineering

The curriculum for all the fields of study in the branch of Civil Engineering, require courses taken from a), b), c) and from the list of elective courses in table 14.5.2.2 below:

14.5.2.2.1 In the field of Geotechnical and Materials Engineering

a) A combination of at least three courses listed below:
   CIVN7023A Deep Foundations and Anchors (20) (NQF 9)
   CIVN7028A Earth Pressures & Retaining Structures (20) (NQF 9)
   CIVN7063A Chemistry, Durability and Performance of Concrete in Structures (20) (NQF 9)
   CIVN7064A Advanced Concrete Technology (20) (NQF 9)
   CIVN7066A Durability, Assessment and Repair of Concrete Structures (20) (NQF 9)

b) Two courses selected from the table of elective courses below as may be offered in any year

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 relevant to the field of study.

d) Successfully complete Research Report (CIVN7019A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.2.2 In the field of Water Engineering

a) A combination of at least three courses listed in a) below:
   CIVN7016A Hydraulic Structures (20) (NQF 9)
   CIVN7035A River Hydraulics (20) (NQF 9)
   CIVN7059A Water Management (20) (NQF 9)
   CIVN7061A Water Supply and Urban Drainage (20) (NQF 9)
   CIVN7065A Water Resources Planning (20) (NQF 9)

b) Two courses selected from the table of elective courses below as may be offered in any year

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 relevant to the field of study.

d) Successfully complete Research Report (CIVN7019A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.2.3 In the field of Structural Engineering

a) A combination of at least three courses listed in a) below:

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
CIVN7005A Dynamic Loading and Analysis of Structures (20) (NQF 9)
CIVN7012A Advanced Design of Structural Steel (20) (NQF 9)
CIVN7036A Finite Element Analysis of Structures (20) (NQF 9)
CIVN7046A Advanced Prestressed Concrete Design (20) (NQF 9)
CIVN7047A Advanced Reinforced Concrete Design (20) (NQF 9)
CIVN7062A Design of Masonry Structures (20) (NQF 9)

b) Two courses selected from the table of elective courses below as may be offered in any year

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 relevant to the field of study.

d) Successfully complete Research Report (CIVN7019A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.2.4 In the field of Project and Construction Management

a) A combination of at least three courses listed below:

(i) The two courses listed below are mandatory:
   CIVN7038A Project Management - Part 1 (20) (NQF 9)
   CIVN7039A Project Management - Part 2 (20) (NQF 9)

(ii) At least one of the following courses:
   CIVN7007A Employment Creation in Construction & Maintenance of Infrastructure (20) (NQF 9)
   CIVN7020A Project Management in Developing Areas (20) (NQF 9)
   CIVN7025A Construction Site Management (20) (NQF 9)

b) Two courses selected from the table of elective courses below as may be offered in any year

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 relevant to the field of study.

d) Successfully complete Research Report (CIVN7019A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.2.5 In the field for Environmental Engineering

a) A combination of at least three courses listed below:

   CIVN7013A Wastewater Engineering (20) (NQF 9)
   CIVN7024A Environmental Management (20) (NQF 9)
   CIVN7044A Pollution Prevention and Abatement (20) (NQF 9)
   CIVN7068A Environmental Engineering Design (20) (NQF 9)

b) Two courses selected from the table of elective courses below as may be offered in any year

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 relevant to the field of study.

d) Successfully complete Research Report (CIVN7019A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

Table 14.5.2.2.5 b) ELECTIVE COURSES for all fields of study in the Branch of Civil Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIVN7007A</td>
<td>Employment Creation in Construction &amp; Maintenance of...</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>CIVN7012A</td>
<td>Advanced Design of Structural Steel</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>CIVN7016A</td>
<td>Hydraulic Structures</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
</tbody>
</table>

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
14.5.2.3 Branch of Electrical Engineering

a) A combination of courses listed below, totalling 80 credits:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELEN7059A</td>
<td>Principles of Communications Systems</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7015A</td>
<td>Teletraffic Engineering</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7064A</td>
<td>Principles of Wireless Communication/LTE</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7062A</td>
<td>Coding Techniques and Telecommunications</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7011A</td>
<td>Selected Topics in Telecommunications</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7044A</td>
<td>Introduction to Software Engineering</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7055A</td>
<td>Database Systems</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7045A</td>
<td>Software Development Methodologies, Analysis &amp; Design</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7046A</td>
<td>Software Technologies and Techniques</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7047A</td>
<td>Software Project Management</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7012A</td>
<td>Selected Topics in Software Engineering</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7009A</td>
<td>Principles of Insulation Coordination</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7018A</td>
<td>Earthing and Lightning Protection</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7043A</td>
<td>Advanced Electromechanical Conversion</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7048A</td>
<td>Variable Speed Drives for AC Machines</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7056A</td>
<td>Power Electronics</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
<tr>
<td>ELEN7013A</td>
<td>Selected Topics in Power Engineering</td>
<td>(20)</td>
<td>(NQF 9)</td>
</tr>
</tbody>
</table>

b) Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other Masters courses relevant to the field of study.
c) Successfully complete a Research Methods in Engineering/Research Methodology course yielding a minimum of 10 credits at NQF level 9 and Research Report (ELEN7000A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.4 Branch of Mechanical, Industrial and Aeronautical Engineering

a) A combination of courses listed below, totalling 80 credits:
   - MECN7005A Engineering Economics (20) (NQF 9)
   - MECN7029A Mathematical Topics for Engineering Management (20) (NQF 9)
   - MECN7006A Production and Ops Management (20) (NQF 9)
   - MECN7017A Value Engineering and Analysis (20) (NQF 9)
   - MECN7020A Manufacturing Strategy (20) (NQF 9)
   - MECN7023A Management of Technology (20) (NQF 9)
   - MECN7028A Lean Manufacturing (20) (NQF 9)
   - MECN7057A Enterprise Engineering (20) (NQF 9)
   - MECN7059A Supply Chain Management (20) (NQF 9)
   - MECN7065A Service Engineering (20) (NQF 9)
   - MECN7001A Reliability Engineering (20) (NQF 9)
   - MECN7024A Maintenance Engineering (20) (NQF 9)
   - MECN7026A Finite Element Methods (20) (NQF 9)
   - MECN7034A Bulk Solids Storage and Handling (20) (NQF 9)
   - MECN7035A Belt Conveying of Bulk Solids (20) (NQF 9)
   - MECN7054A Systems Engineering: Hard Systems Methodologies (20) (NQF 9)
   - MECN7058A Systems Engineering: Soft Systems Methodologies (20) (NQF 9)
   - CIVN7038A Project Management – Part I (20) (NQF 9)
   - CIVN7039A Project Management – Part II (20) (NQF 9)

b) Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other Masters courses at NQF level 9 relevant to the field of study.

c) Successfully complete a Research Methods in Engineering course (MECN7066A) yielding a minimum of 10 credits at NQF level 9 and Research Report (MECN7018A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.5 Branch of Mechanical Engineering

14.5.2.5.1 In the field of Nuclear Technology Leadership

a) A combination of courses listed below, totalling 80 credits:
   - MECN7067A Financial modelling for nuclear energy projects (20) (NQF 9)
   - ELEN7066A Global trends and sustainability (20) (NQF 9)
   - MECN7068A Leadership of nuclear strategy (20) (NQF 9)
   - CIVN7069A Managing the environmental impact of a nuclear energy Project (20) (NQF 9)
   - MECN7069A Regulation and security of nuclear energy projects (20) (NQF 9)
   - MECN7070A Strategic management of the nuclear energy projects

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. Qualification includes any degree, diploma, certicate, licentiate, or any other educational attainment that is offered by the University as stipulated in its list of qualifications.
Lifecycle (20) (NQF 9)

b) Successfully complete a Research Methods in Engineering course (MECN7066A) yielding a minimum of 10 credits at NQF level 9 and Research Report (MECN7018A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.6 Branch of Metallurgy and Materials Engineering

14.5.2.6.1 In the field for Coal Science and Technology

a) A combination of courses listed below, totalling 80 credits:

- CHMT7005A Coal Sampling and Quality Assessment (20) (NQF 9)
- CHMT7006A Coal Management and Marketing (20) (NQF 9)
- CHMT7057A Coal Combustion and Power Generation (20) (NQF 9)
- CHMT7058A Coal Preparation and Beneficiation (20) (NQF 9)
- CHMT7059A Coal Conversion and Gasification (20) (NQF 9)
- CHMT7060A Coal and Carbon in the Metallurgical Industry (20) (NQF 9)
- CHMT7068A Underground Coal Gasification (20) (NQF 9)
- CHMT7069A Carbon Capture in Power Plants (20) (NQF 9)

b) Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other Masters courses relevant to the field of study.

c) Successfully complete a Research Methods in Engineering/Research Methodology course yielding a minimum of 10 credits at NQF level 9 and Research Report (CHMT7008A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.6.2 In the field for Extractive Metallurgy

a) A combination of courses listed below, totalling 80 credits:

- CHMT7028A Physical Processing of Ores (20) (NQF 9)
- CHMT7029A Mineral Beneficiation (20) (NQF 9)
- CHMT7030A Leaching Operations in Hydrometallurgy (20) (NQF 9)
- CHMT7031A Electrometallurgy (20) (NQF 9)
- CHMT7032A Separation Operations in Hydrometallurgy (20) (NQF 9)

b) Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other Masters courses relevant to the field of study.

c) Successfully complete a Research Methods in Engineering/Research Methodology course yielding a minimum of 10 credits at NQF level 9 and Research Report (CHMT7008A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.6.3 In the field for Pyrometallurgy

a) A combination of courses listed below, totalling 80 credits:

- CHMT7013A Solid, Liquid and Gaseous State Pyrometallurgical Processes (20) (NQF 9)
- CHMT7016A Selected /Special Topics in Pyrometallurgy (20) (NQF 9)
- CHMT7011A Physicochemical Principles of Refractory Use (20) (NQF 9)
- CHMT7012A Principles of Modelling and Control of Pyrometallurgical Processes (20) (NQF 9)
- CHMT7014A Kinetics and Transport Phenomena in Pyrometallurgy (20) (NQF 9)
- CHMT7015A Thermodynamics and Phase Equilibria in Pyrometallurgy (20) (NQF 9)

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
b) Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other Masters courses relevant to the field of study.

c) Successfully complete a Research Methods in Engineering/Research Methodology course yielding a minimum of 10 credits at NQF level 9 and Research Report (CHMT7008A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.6.4 In the field for Materials Science and Engineering

a) A combination of courses listed below, totalling 80 credits:
   - CHMT7018A Materials Characterisation (20) (NQF9)
   - CHMT7019A Advanced Materials Processing (20) (NQF9)
   - CHMT7020A Principles of Ceramic Processing (20) (NQF9)
   - CHMT7022A Failure Analysis of Engineering Materials (20) (NQF9)
   - CHMT7024A Structure and Properties of Engineering Materials (20) (NQF9)
   - CHMT7025A Electrical, Magnetic, Optical and Thermal Properties of Materials (20) (NQF9)
   - CHMT7027A Thermodynamics & Phase Equilibria of Materials (20) (NQF9)
   - CHMT7067A Tribology: Friction, Wear and Lubrication (20) (NQF9)
   - CHMT7071A Tribology of Materials (20) (NQF 9)

b) Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other Masters courses relevant to the field of study.

c) Successfully complete a Research Methods in Engineering/Research Methodology course yielding a minimum of 10 credits at NQF level 9 and Research Report (CHMT7008A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.6.5 In the field for Welding Engineering

a) A combination of the courses listed below, totalling 100 credits:
   - CHMT7045A Advanced Welding Processes (20) (NQF 9)
   - CHMT7049A Welding Metallurgy of Steels (20) (NQF 9)
   - CHMT7050A Weldability of Alloy Steels and Stainless Steels (20) (NQF 9)
   - CHMT7051A Welding Processes and Equipment (20) (NQF 9)
   - CHMT7073A Design and Construction of Welded Structures under Static Loading (20) (NQF 9)
   - CHMT7074A Design and construction of Welded Structures under Dynamic Loading (20) (NQF 9)

b) Should a student wish to complete a Research Methods in Engineering/Research Methodology course yielding a minimum of 10 credits at NQF level 9 they may do so, but this is deemed to be an optional course.

d) Successfully complete a Research Report (CHMT7008A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.7 Branch of Mining Engineering

14.5.2.7.1 In the field for Mineral Economics

a) The following courses are prescribed:
   - MINN7014A Mineral Economics (20) (NQF 9)
   - MINN7015A Mineral Policy and Investment (20) (NQF 9)
   - MINN7038A Minerals Marketing (20) (NQF 9)

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
MINN7016A Beneficiation Economics (20) (NQF 9)

b) Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other Masters courses relevant to the field of study.

c) Successfully complete Research Methodology MINN7094A (10) (NQF 9) and Research Report (MINN7044A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.7.2 In the field of Rock Engineering

a) The following courses are prescribed:
   MINN7005A Mechanical Properties of Rocks and Rock Masses (20) (NQF 9)
   MINN7010A Advanced Mechanics of Solids (20) (NQF 9)

b) Two elective courses at the level of master relevant to the field of study approved by the Senate, yielding 20 credits each.

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 relevant to the field of study.

d) Successfully complete Research Methodology MINN7094A (10) (NQF 9) and Research Report (MINN7044A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.7.3 In the field for Mining Geology

a) The following courses are prescribed:
   MINN7021A Geological Orebody Modelling (20) (NQF 9)
   MINN7025A Mining and the Environment (20) (NQF 9)
   MINN7019A Design of the Layout of Underground Mine Excavations (20) (NQF 9)
   MINN7020A Surface Mining (20) (NQF 9)

b) Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other Masters courses relevant to the field of study.

c) Successfully complete Research Methodology MINN7094A (10) (NQF 9) and Research Report (MINN7044A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.7.4 In the field of Mineral Resource Management

a) The following courses are prescribed:
   MINN7092A Mine Financial Valuation (20) (NQF 9)
   MINN7050A Mineral Resource Management (20) (NQF 9)
   MINN7052A Compliance and Reporting Rules in the Mineral Industry (20) (NQF 9)

b) One elective course at the level of master relevant to the field of study approved by the Senate, yielding 20 credits.

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 relevant to the field of study.

d) Successfully complete Research Methodology MINN7094A (10) (NQF 9) and Research Report (MINN7044A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

14.5.2.7.5 In the field for Mineral Resource Evaluation

a) The following courses are prescribed:
   MINN7006A Geostatistical Methods in Mineral Evaluation (20) (NQF 9)
   MINN7007A Statistical Valuation of Ore Reserves (20) (NQF 9)

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. Qualification includes any degree, diploma, certicate, licentiate, or any other educational attainment that is offered by the University as stipulated in its list of qualifications.
14.5.2.7.9 Curriculum for Mechanised Mining Systems

a) The following courses are prescribed:
   - MINN7009A Trackless Mechanised Mining (20) (NQF 9)
   - MINN7080A Earth Moving Equipment, Technology and Management (20)
     (NQF 9)
   - MINN7083A Rock Cutting Technology (20) (NQF 9)
   - MECN7060A Operations Management for Mining Systems (20) (NQF 9)

b) Provided that the Senate may permit a candidate to replace one or more of the
above courses with one or more other Masters courses relevant to the field of study.

c) Successfully complete Research Methodology MINN7094A (10) (NQF 9) and
Research Report (MINN7044A) yielding 90 credits at NQF level 9 on a topic
appropriate to the field of Mechanised Mining Systems.

14.5.2.7.10 In the field for Mine Ventilation Engineering

a) A combination of the following courses, totalling 80 credits:
   - MINN7000A Principles of Ventilation (20) (NQF 9)
   - MINN7001A Environmental Engineering Topics (20) (NQF 9)

b) Two elective courses at the level of master relevant to the field of study approved
by the Senate, yielding 20 credits each.

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 relevant to the field of study.

d) Successfully complete Research Methodology MINN7094A (10) (NQF 9) and
Research Report (MINN7044A) yielding 90 credits at NQF level 9 on a topic
appropriate to the field of Mine Ventilation Engineering.

14.5.2.7.11 In the field of Mineral Asset Valuation

a) The following courses are prescribed:
   - MINN7085A Valuation of Mineral Assets (20) (NQF 9)
   - MINN7086A Valuation and Accounting Standards (20) (NQF 9)
   - MINN7087A Approaches to Valuation in Extractive Industries (20) (NQF 9)
   - MINN7088A Advanced Mineral Asset Valuation (20) (NQF 9)

b) Provided that the Senate may permit a candidate to replace one or more of the
above courses with one or more other Masters courses relevant to the field of study.

c) Successfully complete Research Methodology MINN7094A (10) (NQF 9) and
Research Report (MINN7044A) yielding 90 credits at NQF level 9 on a topic
appropriate to the field of Mineral Asset Valuation.

14.5.2.7.12 In the field for Mine Planning and Optimisation

a) The following courses are prescribed:
   - MINN7092A Mine Financial Valuation (20) (NQF 9)
   - MINN7089A Mine Planning Principles (20) (NQF 9)
   - MINN7093A Applied Operations in Research in Mineral Resource
     Management (20) (NQF 9)

b) One elective course at the level of master relevant to the field of study approved
by the Senate, yielding 20 credits.

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 relevant to the field of study.

d) Successfully complete Research Methodology MINN7094A (10) (NQF 9) and
Research Report (MINN7044A) yielding 90 credits at NQF level 9 on a topic
appropriate to the field of Mine Planning and Optimisation.
14.5.3 Conditions for the award of the MSc(Eng)

i) 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.

ii) 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.

14.6 Deleted

14.7 Master of the Built Environment in the field of Housing (FCA10)

14.7.1 Curriculum

a) A candidate must complete five courses: four compulsory courses and one elective.

- **Compulsory courses**
  - ARPL7004A Housing Theories, Concepts and Policy (20) (NQF 9)
  - ARPL7005A Social and Technical Sustainability in Housing (20) (NQF 9)
  - ARPL7040A Research Methods (10) (NQF 9)
  - ARPL7066A Housing Finance and Law (20) (NQF 9)

- **Elective courses**
  - ARPL7006A Advanced Housing Finance (20) (NQF 9)
  - ARPL7007A Housing Seminar (20) (NQF 9)
  - ARPL7068A Housing Construction Technology and Management (20) (NQF 9)
  - ARPL7067A Management of Existing Housing Stock (20) (NQF 9)

Candidates may, with the approval of the Senate, replace the elective course with other approved courses at the level of master at this or another tertiary education institution, approved by the Senate, for an equivalent minimum of 20 credits.

b) A candidate must also pass Research Report (ARPL7045A) (90 credits) (NQF 9) on a topic appropriate to the field of housing and approved by the Senate.

14.7.2 Conditions for the award of the Master of the Built Environment in the field of Housing

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, provided that no candidate may repeat or substitute courses totalling more than a maximum of 40 credits.

14.8 Master of Architecture (Professional) (FCA02)

14.8.1 Curriculum

- ARPL7001A Advanced Digital Applications (9) (NQF 9)
- ARPL7002A Simulated Office Practice (45) (NQF 9)

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. Qualification includes any degree, diploma, certicate, licentiate, or any other educational attainment that is offered by the University as stipulated in its list of qualifications.
ARPL7003A Architectural Design and Discourse (90) (NQF 9)
ARPL7041A Architectural Professional Practice (36) (NQF 9)

14.8.2 Conditions for the award of the MArch(Prof)

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.

14.9 Master of Urban Design

Master of Urban Design (FCA13)

14.9.1 Curriculum

a) A candidate must complete the four core courses and three elective courses.

Core courses
ARPL7010A Understanding Cities of the South (20) (NQF 9)
ARPL7011A Urban Design Theory and History (20) (NQF 9)
ARPL7040A Research Methods (10) (NQF 9)
ARPL7057A Urban Design Professional Practice (10) (NQF 9)

Elective courses
ARPL7058A Global City Studio (10) (NQF 9)
ARPL7059A Accessible City Studio (10) (NQF 9)
ARPL7060A Sustainable City Studio (10) (NQF 9)
ARPL7061A Transforming City Studio (10) (NQF 9)

Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other courses relevant to the field of urban design.

and

b) A candidate must also pass Research Report (ARPL7062A) (90 credits) (NQF 9) on a topic appropriate to the field of urban design and approved by the Senate.

c) 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

14.9.2 Conditions for the award of the qualification

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.
14.10 Master of Architecture in the field of Sustainable and Energy Efficient Cities

Master of Architecture in the field of Sustainable and Energy Efficient Cities (FCA12)

14.10.1 Curriculum

a) A candidate must complete four core courses and elective courses comprising at least 20 credits.

   Core courses
   ARPL7010A Understanding Cities of the South (20) (NQF 9)
   ARPL7040A Research Methods (10) (NQF 9)
   ARPL7054A Energy for Sustainable Cities (20) (NQF 9)
   ARPL7055A Energy Efficiency and Renewable Energy for Buildings (20) (NQF 9)

   Elective courses
   ARPL7005A Social and Technical Sustainability in Housing (20) (NQF 9)
   ARPL7032A Environmental Planning and Sustainable Development (20) (NQF 9)
   ARPL7060A Sustainable City Studio (10) (NQF 9)

   b) A candidate must also pass Research Report (ARPL7056A) (90) (NQF 9) on a topic appropriate to the field of Sustainable and Energy Efficient Cities and approved by the Senate.

   c) 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

14.10.2 Conditions for the award of the qualification

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.

14.11 Deleted

14.12 Master in Urban Studies (FC014)

14.12.1 Curriculum

a) A candidate must complete four core courses and at least one elective course

   Core courses
   ARPL7010 Understanding Cities of the South (20) (NQF 9)
   ARPL7040 Research Methods (10) (NQF 9)
   ARPL7044 Community Participation in Urban Governance: Discourses, Theories and Practices (20) (NQF 9)
   ARPL7048 Democratic Theory (20) (NQF 9)

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
Elective courses

ARPL7004 Housing Theories, Concepts and Policies (20) (NQF 9)
ARPL7030 Municipal Planning (20) (NQF 9)
ARPL7034 Selected Topics in Planning (20) (NQF 9)
ARPL7049 Politics, Governance and the City (20) (NQF 9)
ARPL7050 The Making of Urban South Africa (20) (NQF 9)
ARPL7051 Violence, States, Movements (20) (NQF 9)

b) 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, for an equivalent minimum of 20 credits.

and

c) A candidate must also pass Research Report (ARPL7053) (90 credits) (NQF 9) on a topic appropriate to the field of urban studies and approved by the Senate.

d) 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: Technologies and Techniques for the Built Environment (ARPL7052)

14.12.2 Conditions for the award of the qualification

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.

P15 Master by coursework

P15.1 Master of Engineering (EC001)

15.1.1 Length of curriculum

For the Master of Engineering the curriculum extends over not less than one academic year of full time study or two academic years of part time study.

15.1.2 Curricula

A candidate for the Master of Engineering must complete a programme approved by the Senate of advanced coursework in a field determined by the Senate from time to time. An approved curriculum consists of core and elective courses with credits totalling not fewer than 240 credits. In the case of a candidate who selects one or more courses offered by another discipline, at least 200 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. The curriculum must include one or two 40 point courses aimed at developing professional competencies.

15.1.3 Fields of study

The Master of Engineering is offered in the following fields within a branch:

NOTE: The suggested courses are listed in the Faculty Graduate Studies handbook.
• **Branch of Civil Engineering**
  Geotechnical and Materials Engineering
  Water Engineering
  Structural Engineering
  Project and Construction Management
  Environmental Engineering

• **Branch of Electrical Engineering**
  Telecommunications
  Information and Software Engineering
  Power Engineering

• **Branch of Industrial Engineering**
  Not all of the following fields are offered in any year
  Engineering Management
  Industrial Engineering
  Systems Engineering

• **Branch of Mechanical Engineering**
  Thermodynamics
  Applied Mechanics
  Design and Manufacturing
  Mechanised Mining Systems
  Ventilation Engineering
  Bulk Materials Handling

• **Branch of Metallurgy and Materials Engineering**
  Materials Science and Engineering
  Mineral Processing and Extractive Metallurgy
  Welding Engineering

• **Branch of Mining Engineering**
  Mineral Economics
  Rock Mechanics
  Mining Geology
  Mineral Resource Management
  Mineral Resource Evaluation
  Safety, Health, Environment and Community
  Mechanised Mining Systems
  Ventilation Engineering
  Bulk Materials Handling

**15.1.4 Conditions for the award of the Master of Engineering**

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.

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*Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.*
P16 Conversion

16.1 Conversion from 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 his/her candidature for the qualification for which s/he is currently registered.

b) For a person converting to 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(Eng) namely: complete advanced coursework consisting of core and elective courses with credits totalling not fewer than 120 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 totalling not fewer than 240 credits.

16.2 Deleted

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P17 Master of Science

17.1 Master of Science in Aeronautical Engineering (ECA02)

Dual Degree: Candidates may present themselves for a dual degree offered in collaboration with Embry Riddle Aeronautical University.

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 a programme of four courses yielding 20 credits each 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 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.
The **Research Report** must be submitted to both Embry Riddle Aeronautical University (ERAU) and this University and must satisfy the examining requirements of both institutions. This will require that two versions of the report be compiled to meet the submission requirements of both institutions.

### 17.1.1 Length of curriculum

The **curriculum** for Master of Science in Aeronautical Engineering extends over not less than one academic year of full time study or two academic years of part time study.

### 17.1.2 Curricula

**a)** The following courses are prescribed:

- MECN7094A  The Air Transportation System (20) (NQF 9)
- MECN7095A  Human Factors in the Aviation/Aerospace Industry (20) (NQF 9)

**b)** Course(s) selected from the list of elective courses below as may be offered in any year, totalling a minimum of 20 or maximum 40 credits:

- MECN7096A  Advanced Aerodynamics (20) (NQF 9)
- MECN7097A  Earth Observation and Remote Sensing (20) (NQF 9)
- MECN7098A  Aviation/Aerospace Simulation Systems (20) (NQF 9)
- MECN7099A  Applications in Crew Resource Management (20) (NQF 9)
- MECN7102A  Advanced Rotorcraft Operations (20) (NQF 9)
- MECN7101A  Applications in Space: Commerce Defence and Exploration (20) (NQF 9)
- MECN7100A  Unmanned Aerospace Systems (20) (NQF 9)
- MECN7103A  Aircraft and Space Craft Development (20) (NQF 9)
- MECN7104A  Aerospace Accident Investigation and Analysis (20) (NQF 9)
- MECN7105A  Airport Safety and Certification (20) (NQF 9)
- MECN7106A  Management of Research and Development for the Aerospace Industry (20) (NQF 9)

**c)** Should a total of 20 credits have been selected in b) above, then one course may be selected from the list of courses below as may be offered in any year, yielding 20 credits:

- MECN7001A  Reliability Engineering (20) (NQF 9)
- MECN7006A  Production and Operations Management (20) (NQF 9)
- MECN7017A  Value Engineering and Analysis (20) (NQF 9)
- MECN7020A  Manufacturing Strategy (20) (NQF 9)
- MECN7023A  Management of Technology (20) (NQF 9)
- MECN7024A  Maintenance Engineering (20) (NQF 9)
- MECN7026A  Finite Element Methods (20) (NQF 9)
- MECN7028A  Lean Manufacturing (20) (NQF 9)
- MECN7054A  Systems Engineering: Hard Systems Methodologies (20) (NQF 9)
- MECN7058A  Systems Engineering: Soft Systems Methodologies (20) (NQF 9)
- MECN7059A  Supply Chain Management (20) (NQF 9)

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Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. Qualification includes any degree, diploma, certicate, licentiate, or any other educational attainment that is offered by the University as stipulated in its list of qualifications.
d) Successfully complete a Research Methods in Engineering course (MECN7066A) yielding a minimum of 10 credits at NQF level 9 and Research Report (MECN7018A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

17.1.3 Conditions for the award of the Master of Science in Aeronautical Engineering

i) 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.

ii) 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.

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

17.2 Master of Science in Bulk Materials Handling (ECA03)

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 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.

17.2.1 Length of curriculum

The curriculum for the Master of Science in Bulk Materials Handling extends over not less than one academic year of full time study or two academic years of part time study.

17.2.2 Curricula

a) The following courses are prescribed:

- MECN 7034A  Bulk Solids Storage and Handling (20) (NQF 9)
- MECN 7035A  Belt Conveying of Bulk Solids (20) (NQF 9)
- MECN 7071A  Pipeline Conveying of Bulk Materials (20) (NQF 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 Masters level from Mechanical or Mining Engineering, as may be offered in any year, yielding 20 credits.

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
c) Successfully complete 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 to the field of study.

17.2.3 Conditions for the award of the Master of Science in Bulk Materials Handling

i) 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.

ii) 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.

17.3 Master of Science in Engineering Management (ECA04)

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 Senate from time to time.

A candidate may be required in terms of 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.

17.3.1 Length of curriculum

The curriculum for the Master of Science in Engineering Management extends over not less than one academic year of full time study or two academic years of part time study.

17.3.2 Curricula

a) Courses selected from the list of courses below as may be offered in any year, totalling a minimum of 60 credits:

MECN7005A Engineering Economics (20) (NQF 9)
MECN7007A Elements of Commercial and Industrial Law (20) (NQF 9)
MECN7008A Financial Management (20) (NQF 9)
MECN7009A Principles of Management (20) (NQF 9)
MECN7010A Human Resource Management (20) (NQF 9)
MECN7011A Accounting and Financial Statements (20) (NQF 9)
MECN7029A Mathematical Topics for Engineering Management (20) (NQF 9)
MECN7032A Management Accounting (20) (NQF 9)
MECN7051A Business to Business Marketing (20) (NQF 9)

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
b) One elective course selected from courses at a Masters level from Industrial 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 NQF level 9 and a Research Report (MECN7018A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of study.

17.3.3 Conditions for the award of the Master of Science in Engineering Management

i) 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.

ii) 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.

17.4 Master of Science in Mechanical Engineering (ECA05)

For the Master of Science in Mechanical 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 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 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.

17.4.1 Length of curriculum

The curriculum for the Master of Science in Mechanical Engineering extends over not less than one academic year of full time study or two academic years of part time study.

17.4.2 Curricula

a) Courses selected from the list of courses below as may be offered in any year, totalling a minimum of 60 credits:

- MECN7001A  Reliability Engineering (20) (NQF 9)
- MECN7013A  Principles of Air Conditioning (20) (NQF 9)
- MECN7014A  Principles of Refrigeration (20) (NQF 9)
- MECN7019A  Internal Combustion Engine Analysis (20) (NQF 9)
- MECN7021A  Analysis of Composite Structures (20) (NQF 9)
- MECN7024A  Maintenance Engineering (20) (NQF 9)
- MECN7026A  Finite Element Methods (20) (NQF 9)
- MECN7033A  Automotive Engineering (20) (NQF 9)

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
b) One elective course selected from courses at a Masters level from Industrial Engineering, Systems Engineering or Aeronautical 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 NQF level 9 and a Research Report (MECN7018A) yielding 90 credits at NQF level 9 on a topic appropriate to the field of Mechanical Engineering.

17.4.3 Conditions for the award of the Master of Science in Mechanical Engineering

i) 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.

ii) 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.

17.5 Master of Science in Industrial Engineering (ECA06)

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 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 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 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.

17.5.1 Length of curriculum

The curriculum for the Master of Science in Industrial Engineering extends over not less than one academic year of full time study or two academic years of part time study.

17.5.2 Curricula

a) Courses selected from the list of courses below as may be offered in any year, totalling a minimum of 60 credits:

- MECN7000A Operational Research Methods (20) (NQF 9)
- MECN 7006A Production and Operations Management (20) (NQF 9)

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
MECN7060A  Operations Management for Mining Systems (20) (NQF 9)
MECN7016A  Quality Management (20) (NQF 9)
MECN 7017A  Value Engineering and Analysis (20) (NQF 9)
MECN 7020A  Manufacturing Strategy (20) (NQF 9)
MECN 7023A  Management of Technology (20) (NQF 9)
MECN7027A  Discrete Event Simulation (20) (NQF 9)
MECN 7028A  Lean Manufacturing (20) (NQF 9)
MECN7029A  Mathematical Topics for Engineering Management (20) (NQF 9)
MECN7054A  Systems Engineering: Soft Systems Methodologies (20) (NQF 9)
MECN7062A  Systems Engineering: An Overview (20) (NQF 9)
MECN7057A  Enterprise Engineering (20) (NQF 9)
MECN 7059A  Supply Chain Management (20) (NQF 9)
MECN 7065A  Service Engineering (20) (NQF 9)

b) One elective course selected from courses at a Masters level from Engineering Management or Mechanical Engineering, as may be offered in any year, totalling 20 credits.

c) Successfully complete 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 to the field of Industrial Engineering.

17.5.3 Conditions for the award of the Master of Science in Industrial Engineering

i) 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.

ii) 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.

17.6 Master of Science in Systems Engineering (ECA07)

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 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 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.

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
17.6.1 Length of curriculum

The curriculum of the Master of Science in Systems Engineering extends over not less than one academic year of full time study or two academic years of part time study.

17.6.2 Curricula

a) The following course is prescribed:

MECN7058A  Systems Engineering: Hard Systems (20) (NQF 9)

b) Courses selected from the list of courses below as may be offered in any year, totalling a minimum of 40 credits:

MECN7053A  Systems Engineering Management (20) (NQF 9)
MECN7054A  Systems Engineering: Soft Systems Methodologies (20) (NQF 9)
MECN7062A  Systems Engineering: An Overview (20) (NQF 9)
MECN7055A  Requirements Analysis in Systems Engineering (20) (NQF 9)
MECN7056A  Systems Engineering: Architecture (20) (NQF 9)
MECN7063A  Systems Engineering – Modelling and Simulation: Principles and Approaches (20) (NQF 9)
MECN7064A  Systems Engineering: Integration, Verification and Validation (20) (NQF 9)

c) One elective course selected from courses at a Masters level from Industrial Engineering or Mechanical Engineering, as may be offered in any year, totalling 20 credits.

d) Successfully complete 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 to the field of study.

17.6.3 Conditions for the award of the Master of Science in Systems Engineering

i) 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.

ii) 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.

P18 Conversion

18.1 Conversion from Master of Science (by Coursework and a Research Report) to Master of Science by research

A person who has been admitted to the Master of Science (by coursework and a Research Report) 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.

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
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.

For a person converting to a Master of Science by coursework and a Research
Report, in addition to (a) above, such a person must meet all requirements for the
MSc namely: complete advanced coursework consisting of core and elective
courses with credits totalling not fewer than 90 credits and submit a Research
Report.

**P19 Deleted**

**Doctoral Awards**

**P20 Doctor of Philosophy**

**20.1 Admission**

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 Science in Urban and Regional Planning of this University;
- j) a Master of Urban Design of this University;
- k) a Master of Science in Aeronautical Engineering of this University;
- l) a Master of Science in Engineering Management of this University;
- m) a Master of Science in Industrial Engineering of this University;
- n) a Master of Science in Mechanical Engineering of this University;
- o) a Master of Science in Systems Engineering of this University;
- p) a Master of Science in Bulk Materials Science of this University;
- q) by special permission of the Senate, a Bachelor of Architecture, a Bachelor of
Science in Quantity Surveying, a Bachelor of Science with Honours in Quantity
Surveying, a Bachelor of Science in Town and Regional Planning, a Bachelor of
Science with Honours in Urban and Regional Planning, a Bachelor of Science in
Building or Construction Management, a Bachelor of Science with Honours in
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 at least ten years;
- r) 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) to (r) 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;
- s) a person who has in any other manner satisfied the Senate that s/he is so qualified.

Note: 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. A programme is a course
or set of courses or postgraduate research which may lead to a qualification. 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.
20.2 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 at least 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 at least 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.

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

20.4 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 herself/himself for such assessment as the Senate may determine.

P21 Senior Doctor
21.1 Admission
21.1.1 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 at least five years; or

b) a Doctor of Philosophy of this or another university who has held that qualification for at least 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 at least five years.

21.1.2 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 at least five years standing or who has held the Bachelor of Science in Engineering for at least six years; or

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
b) a Doctor of Philosophy of this or any other University of at least 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 at least five years.

21.1.3 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 at least five years; or

b) a Doctor of Philosophy of this or another university who has held that qualification for at least 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 at least five years.

21.1.4 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 at least five years; or

b) a Doctor of Philosophy of this or another university who has held that qualification for at least 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 at least five years.

21.1.5 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 at least five years’ standing or who has held the Bachelor of Science in Engineering for at least six years; or

b) a Doctor of Philosophy of this or any other University of at least 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 at least five years.

21.1.6 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:

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. Qualification includes any degree, diploma, certicate, licence, or any other educational attainment that is offered by the University as stipulated in its list of qualifications.
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.

21.2.3 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 Urban 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.

Postgraduate Diplomas

P31 Postgraduate Diploma in Engineering (EXA01)

31.1 Eligibility for admission

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:

a) 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 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.

b) 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.

c) a person other than a graduate who has in any other manner satisfied the Senate
that s/he is so qualified.

31.2 Length and conditions of curriculum

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 at least three but not more than five courses.

31.3 Curricula

A candidate for the Postgraduate Diploma in Engineering must follow an approved
curriculum consisting of core and elective courses with credits totalling not fewer than 120

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portion thereof, that is recognised in any of the faculty rules as a component of a qualification. A programme is a course
or set of courses or postgraduate research which may lead to a qualification. 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.
credits. In the case of a candidate who selects one or more courses offered by another
discipline, at least 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.

31.3.1 Branches of study

The Postgraduate Diploma in Engineering is offered in the following branches and fields
within a branch:

31.3.1.1 Branch of Aeronautical Engineering

The following courses are prescribed:

- MECN5008A  Aerodynamics (20) (NQF 8)
- MECN5009A  Flight Dynamics and Control (20) (NQF 8)
- MECN5010A  Aircraft Structures (20) (NQF 8)
- MECN5011A  Compressible Flow and Propulsion (20) (NQF 8)
- MECN5005A  Systems Management (20) (NQF 8)
- MECN5007A  Engineering Investigation (20) (NQF 8)

31.3.1.2 Branch of Chemical Engineering

31.3.1.2.1 In the field of Oil and Gas Engineering

The following courses are prescribed:

- CHMT5006A  Introduction to Petroleum and Offshore Operations (20) (NQF 8)
- CHMT5007A  Petroleum Reservoir and Production Engineering (20) (NQF 8)
- CHMT5008A  Drilling and Completion Engineering with Laboratory (20) (NQF 8)
- CHMT5009A  Risk Management and Sustainable Development in Oil & Gas
  Engineering (20) (NQF 8)
- CHMT5010A  Natural Gas Production and Oilfield Processing (20) (NQF 8)
- CHMT5011A  Oil and Gas Engineering Projects (20) (NQF 8)
- CHMT5012A  Vacation/Industrial Training (Oil & Gas Engineering)

31.3.1.3 Branch of Electrical Engineering

a) Courses selected from the list of courses below as may be offered in any year,
totalling 120 credits:

- ELEN5000A  Measurement Systems (20) (NQF 8)
- ELEN5001A  High Frequency Techniques (20) (NQF 8)
- ELEN5002A  High Voltage Engineering (20) (NQF 8)
- ELEN5003A  Software Engineering (20) (NQF 8)
- ELEN5004A  Software Development (20) (NQF 8)
- ELEN5005A  Electromechanical Conversion (20) (NQF 8)
- ELEN5006A  Network Fundamentals (20) (NQF 8)
- ELEN5007A  Control II (20) (NQF 8)
- ELEN5008A  Power systems (20) (NQF 8)

b) Provided that the Senate may permit a candidate to replace one or more of the
above courses with one or more other postgraduate diploma courses at NQF level
8 relevant to the field of study.

Note: 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. A programme is a course
or set of courses or postgraduate research which may lead to a qualification. Qualification includes any degree, diploma,
certicate, licentiate, or any other educational attainment that is offered by the University as stipulated in its list of
qualifications.
31.3.1.4 Branch of Industrial Engineering

The courses listed below are prescribed:

MECN5002A  Operations Management (20) (NQF8)
MECN5003A  Operations Research Methods (20) (NQF8)
MECN5004A  Manufacturing Technology Principles (20) (NQF8)
MECN5005A  Systems Management (20) (NQF8)
MECN5006A  Business Planning Studies (20) (NQF8)
MECN5007A  Engineering Investigation (20) (NQF8)

31.3.1.5 Branch of Mechanical Engineering

The courses listed below are prescribed:

MECN5013A  Thermal System (20) (NQF8)
MECN5014A  Fluid Dynamics (20) (NQF8)
MECN5015A  Mechatronics (20) (NQF8)
MECN5012A  Mechanics of Solids (20) (NQF8)
MECN5007A  Engineering Investigation (20) (NQF8)
MECN5005A  Systems Management (20) (NQF8)

31.3.1.6 Branch of Metallurgy and Materials Engineering

31.3.1.6.1 In the field of Metallurgy:

The courses listed below are prescribed:

CHMT5000A  Introduction to Extractive Metallurgy (20) (NQF8)
CHMT5001A  Metallurgical Process Modelling & Design (20) (NQF8)
CHMT5002A  Extractive Metallurgy Investigative Project (20) (NQF8)
CHMT5003A  Principles of Hydrometallurgy (20) (NQF8)
CHMT5004A  Principles of Mineral Processing (20) (NQF8)
CHMT5005A  Principles of Pyrometallurgy (20) (NQF8)

31.3.1.6.2 In the field of Welding Design:

The courses listed below are prescribed:

CHMT5013A  Design and Construction of Welded Structures under Static Loading (20) (NQF8)
CHMT5014A  Design and Construction of Welded Structures under Dynamic Loading (20) (NQF8)
CHMT5015A  Practical Education Welding and Fabrication Processes (20) (NQF8)
CHMT5016A  Fabrication Applications Engineering (20) (NQF8)
CHMT5017A  Non-Destructive Testing Methods and Economics (20) (NQF8)
CHMT5018A  Case Studies for Welding Engineers (20) (NQF8)

31.3.1.6.3 In the field of Welding Metallurgy:

The courses listed below are prescribed:

CHMT5019A  Welding Metallurgy of Steels (20) (NQF8)
CHMT5020A  Weldability of Alloy Steels and Stainless Steels (20) (NQF8)
CHMT5021A  Weldability of Ferrous and Non-Ferrous Materials (20) (NQF8)
CHMT5022A  Welding Processes and Equipment (20) (NQF8)
CHMT5023A  Other Welding Processes (20) (NQF8)
CHMT5024A  Advanced Welding Processes (20) (NQF8)

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31.3.1.6.4 In the field of Welding Process

A combination of courses listed below, totalling 120 credits:

- CHMT5022A  Welding Processes and Equipment (20) (NQF8)
- CHMT5023A  Other Welding Processes (20) (NQF8)
- CHMT5024A  Advanced Welding Processes (20) (NQF8)
- CHMT5015A  Practical Education Welding and Fabrication Processes (20) (NQF8)
- CHMT5016A  Fabrication Applications Engineering (20) (NQF8)
- CHMT5017A  Non-Destructive Testing Methods and Economics (20) (NQF8)
- CHMT5018A  Case Studies for Welding Engineers (20) (NQF8)

31.3  Conditions for award of diploma

A candidate for the diploma shall attend and pass courses approved by the Senate totalling 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.

31.4  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.

P32  Postgraduate Diploma in Property Development and Management

32.1 Postgraduate Diploma in Property Development and Management (FXA02)

32.1.2 Eligibility for admission

Any of the following may be admitted by the Senate as a candidate for the PGDipPDM:

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 at least 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.

32.1.3 Length of curriculum

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

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32.1.4 Curricula

The Postgraduate Diploma in Property Development and Management is offered in two fields of study:

32.1.4.1 In the field of **Property Development and Management**

The following courses prescribed:

- **BUQS5021A** Law for Property Development and Management I (10) (NQF 8)
- **BUQS5022A** Law for Property Development and Management II (10) (NQF 8)
- **BUQS5023A** Real Estate Market Analysis (10) (NQF 8)
- **BUQS5024A** Real Estate Valuation (10) (NQF 8)
- **BUQS5025A** Quantitative Methods for Property Studies (20) (NQF 8)
- **BUQS5026A** Commercial Real Estate Investments (10) (NQF 8)
- **BUQS5027A** Applied Macroeconomics (10) (NQF 8)
- **BUQS5028A** Real Estate Finance (10) (NQF 8)
- **BUQS5029A** Real Estate Development (10) (NQF 8)
- **BUQS5030A** Real Estate Brokerage (10) (NQF 8)
- **BUQS5031A** Real Estate and Asset Management (20) (NQF 8)
- **BUQS5032A** Management and Leadership for the Property Sector (20) (NQF 8)

32.1.4.2 In the field of **Facilities Management**

The following courses are prescribed:

First year of study:

- **BUQS5023A** Real Estate Market Analysis (10) (NQF 8)
- **BUQS5026A** Commercial Real Estate Investment (10) (NQF 8)
- **BUQS5028A** Real Estate Finance (10) (NQF 8)
- **BUQS5033A** Introduction to Facilities Management (10) (NQF 8)
- **BUQS5034A** Building Services (10) (NQF 8)
- **BUQS5035A** Strategic Planning (10) (NQF 8)
- **BUQS5036A** Commercial/Procurement Law (10) (NQF 8)
- **BUQS5037A** Space and Workplace Management (10) (NQF 8)

Second year of study:

- **BUQS5031A** Real Estate and Asset Management (20) (NQF 8)
- **BUQS5038A** Information Technology in Facilities Management (10) (NQF 8)
- **BUQS5039A** Project Management in Facilities Management (10) (NQF 8)
- **BUQS5040A** Environmental Management (10) (NQF 8)
- **BUQS5041A** Occupational Health and Safety (10) (NQF 8)
- **BUQS5042A** Advanced Facilities Management (10) (NQF 8)

32.13 Prerequisite courses

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

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<td>BUQS5024A</td>
<td>Real Estate Valuation</td>
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<td>Real Estate Finance</td>
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<td>Real Estate and Asset Management</td>
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### 32.14 Academic Progression

a) A student will be admitted to the next year of study within the two-year part-time study if:

b) (i) s/he has obtained all the credits in all the units prescribed; or

c) (ii) s/he has obtained credits in all the units shown in 32.11/32.13 above for the appropriate year and qualification; and s/he has failed to obtain credit in no more than one of the other units prescribed for that year of study.

d) 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 units 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 units prescribed for the next year of study as the Senate may determine in her/his case.

e) 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 units in her/his current year of study must include in her/his curriculum the unit in which s/he failed to obtain credit.

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Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. Qualification includes any degree, diploma, certicate, licentiate, or any other educational attainment that is offered by the University as stipulated in its list of qualifications.
32.15 Completion and repetition of courses

a) 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).

b) 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.

P33 Postgraduate Diploma in Planning (FX003)

33.1 Eligibility for admission

Any of the following may be admitted by the Senate as a candidate for the PGDipPlanning:

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;

c) candidates with a BTech in other fields;

d) candidates with a national diploma in Urban, Rural and Regional Planning and at least six years of experience in planning practice.

33.2 Length of curriculum

The curriculum for the diploma shall extend over one academic year of full-time study or two years of part-time study.

33.3 Conditions for the award of the diploma

A candidate is required to pass courses totalling at least 150 credits.

33.4 Curriculum

The following courses:

- ARPL5004 Cities, Development and Planning (20) (NQF 8)
- ARPL5005 Spatial Planning, Transport and Infrastructure (30) (NQF 8)
- ARPL5006 Planning Law and Professional Practice (30) (NQF 8)
- ARPL5007 Technologies and Techniques of Planning (10) (NQF 8)
- ARPL5008 Planning, Environment and Sustainability (20) (NQF 8)
- ARPL5009 Urban and Regional Economic Development (20) (NQF 8)
- ARPL5010 Integrated Development Planning (20) (NQF 8)

Provided that the Senate may permit a candidate to replace one or more of the above courses with one or more other courses 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% of the credits yielded by the coursework requirements of the diploma.

33.5 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 totalling more than 40 credits. If a candidate has failed courses totalling 40 credits or more altogether, her/his registration for the diploma may be cancelled unless the Senate is satisfied that there are exceptional circumstances.

Note: 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. A programme is a course or set of courses or postgraduate research which may lead to a qualification. 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.
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.

**OUTCOMES**

1. **Degrees of Bachelor**
   1.1 **Bachelor of Architectural Studies [BAS]**

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Bachelor of Architectural Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>BAS</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>3 years full-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 6</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 390</td>
</tr>
</tbody>
</table>

**Exit Level Outcome 1**
The qualifying learner is able to present material using effective and appropriate visual techniques in two and three dimensions.

**Associated Assessment Criteria**
The qualifying learner 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 learner 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 learner 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 learner shows design and problem solving competencies.

**Associated Assessment Criteria**
The qualifying learner 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 learner is able to communicate appropriately and effectively.

Associated Assessment Criteria
The qualifying learner 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 learner has the capacity for independent thought and practice.

Associated Assessment Criteria
The qualifying learner demonstrates skills of time management, prioritisation and initiative in order to perform adequately all facets of the programme.

Exit Level Outcome 6
The qualifying learner has experience working in groups with peers and s/he has worked directly with communities in a consultative role.

Associated Assessment Criteria
The qualifying learner demonstrates collaborative, group participation and consultative skills.

Exit Level Outcome 7
The qualifying learner is familiar with current technological knowledge in the field of study and its related disciplines.

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

Associated Assessment Criteria
The qualifying learner 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.

1.2 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 6
SAQA Credits                      Total minimum 390

Exit Level Outcome 1
The learner 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 learner 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 learner 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 learner 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 learner 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 learner 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 learner 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 learner works well in a multi-disciplinary team environment and to appreciate the value of diversity in skills.

Associated Assessment Criterion
Demonstrates an ability to work in a team environment with engineers, physicists, chemists, doctors and other professionals.

Exit Level Outcome 9
The learner 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 Criterion
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
Learner 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.

1.3 Bachelor of Engineering Science [BEngSc]

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Bachelor of Engineering Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>BEngSc</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>3 years full-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 7</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 380</td>
</tr>
</tbody>
</table>

Exit Level Outcomes 1
Develop a comprehensive understanding of physical systems.

Associated Assessment Criteria
- Demonstrate an understanding of the basic models and theories that govern physical systems.
- Demonstrate an understanding of the interaction of systems with each other.

Exit Level Outcomes 2
Use knowledge of physical systems to appreciate the complexities and ethical considerations in science and technology.

Associated Assessment Criteria
- Demonstrate an understanding of the principles of the latest appropriate technologies.
- Demonstrate an understanding of the ethical dilemmas associated with new and existing technologies

Exit Level Outcomes 3
Develop a thorough understanding of engineering science and its wider applicability.

Associated Assessment Criteria
- Solve engineering problems and do quantitative analyses.
- Estimate the magnitude of answers prior to calculating, using sound engineering judgment.
- Apply engineering sciences to diverse fields.
- Demonstrate insight into uncertainty in science and its effect on understanding.
Exit Level Outcomes 4
Communicate technical ideas effectively.

Associated Assessment Criteria
- Construct verbal presentations on complex technical subjects.
- Use effective written communication in research reports and problem solving.

Exit Level Outcomes 5
Integrate science and engineering and appreciate the principles common to both disciplines.

Associated Assessment Criteria
- Demonstrate an understanding of systems theory and its applicability across a range of subjects.
- Demonstrate understanding of the way in which many engineering processes have analogues in the physical world.

Exit Level Outcomes 6
Comprehend the social and environmental impact of science and engineering in a South African context.
- Compose a useful assessment of the cost-benefit ratio of advanced technologies.

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

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Bachelor of Science in Construction Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>BSc (Construction Studies)</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>3 years full-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 7</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 418</td>
</tr>
</tbody>
</table>

Exit Level Outcomes
- The learner is competent to identify, analyse and solve problems in the field of construction assembly and management of the process.
- The learner 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
1. The learner 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.
2. The learner 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
3. The learner 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.
4. Use information systems with competence, including the use of relevant software systems, management packages, general construction/design packages and communication systems.
5. 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.

1.5 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 7
SAQA Credits: Total minimum 600

1. Engineering competence

Exit Level Outcome
The qualifying learner 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 learner demonstrates ability to:

• complete at all levels of study, individually and as a member of a team of learners, 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 learner meets the minimum requirements in six defined knowledge areas:

2 **Mathematics**

**Exit Level Outcomes**

The qualifying learner is competent to bring mathematical, numerical analysis and statistical knowledge and methods to bear on engineering problems.

**Associated Assessment Criteria**

The qualifying learner 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 learner 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 learner 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 **Engineeing Sciences**

Exit Level Outcome
The qualifying learner is competent in defined areas of engineering science to use the techniques, principles and laws of engineering science.

Associated Assessment Criteria
The qualifying learner 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 learner may demonstrate in specific cases.

5 **Engineering Design and Synthesis**

Exit Level Outcome
The qualifying learner 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 learner 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 learner is competent to use appropriate computing and information technology applications.

Associated Assessment Criteria
The qualifying learner is competent to:
• use computer packages for computation, modelling, simulation, and information handling, involving;
• assessment of the applicability and limitations of the package;
Outcomes for Engineering and the Built Environment

- 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 learner 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 learner 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.

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

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Bachelor of Science in Property Studies</th>
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</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>BSc(Property Studies)</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>4 years full-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 7</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 480</td>
</tr>
</tbody>
</table>

It is expected that the graduate will be able to:

1. 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;

2. Develop coherent and consistent argument and communicate ideas clearly, concisely and logically in spoken, written numerical and graphical form, as appropriate;

3. Research, interpret and evaluate information, critically appraise current attitudes and methods and develop a creative and innovative approach to the discipline of property;

4. 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;

5. 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;
Outcomes for Engineering and the Built Environment

6 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.

1.7 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 6

SAQA Credits: Total minimum 360

Exit Level Outcome 1
The qualifying learner understands planning and development issues important to the South African context.

Associated Assessment Criteria
The qualifying learner 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 learner has knowledge of how to manage uncertainty within a changing temporal, socio-economic, political and environmental context.

Associated Assessment Criteria
The qualifying learner demonstrates:

- the ability to identify and address complex problems by employing 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 learner is able to cope with South Africa’s diverse social and cultural dynamics.

Associated Assessment Criteria
The qualifying learner demonstrates competency in the skills necessary to deal with the complexities of:

- multi-disciplinary team-work;
Outcomes for Engineering and the Built Environment

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

Exit Level Outcome 4
The qualifying learner 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 learner 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 learner 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 learner 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 learner 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 learner 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 learners.

2. Degrees of Bachelor with Honours

2.1 Bachelor of Architectural Studies with Honours [BASHons]

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Bachelor of Architectural Studies with Honours</th>
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</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>BASHons</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>1 year full-time or 2 years part-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 7</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 120</td>
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</tbody>
</table>
Exit Level Outcome 1
The qualifying learner 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 learner:
• 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 learner has a working knowledge of and skills in the methodology/s and practice of architectural research.

Associated Assessment Criteria
The qualifying learner:
• 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 learner shows general design and problem solving competencies and is able to apply them in a number of specialist applications.

Associated Assessment Criteria
The qualifying learner 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 learner is familiar with current technological knowledge in the field of study and its related disciplines.

Associated Assessment Criteria
The qualifying learner 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 learner is able to communicate appropriately and effectively.
Associated Assessment Criteria
The qualifying learner 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 learner is able to present material using effective and appropriate visual techniques in two and three dimensions.

Associated Assessment Criteria
The qualifying learner 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 learner demonstrates self-directed, independent thought and practice.

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

Exit Level Outcome 8
The qualifying learner has experience in group work with peers and is able to worked directly with communities in a consultative role.

Associated Assessment Criteria
The qualifying learner 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 learner 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 learner 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 learner reflects and acts upon a wide range of learning strategies, both existing and innovative.

Associated Assessment Criteria
The qualifying learner 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.

2.2 Bachelor of Science with Honours in Construction Management [BSc Hons(CM)]

Qualification Title
Bachelor of Science with Honours in Construction Management

Qualification Abbreviation
BSc Hons(CM)

Minimum Period of Study
1 year full-time

NQF Exit Level
Level 7

SAQA Credits
Total minimum 120

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

1. identify, assess and solve open-ended project management/construction related problems creatively and innovatively within limits of own knowledge;
2. perform basic construction trade skills;
3. use computer packages for project management and construction related information processing;
4. manage and prepare tender and contractual documents relating to construction projects;
5. cost and undertake financial management of construction developments;
6. manage the costs of the construction of buildings and related infrastructure;
7. manage the human resources within project management or construction based organisations;
8. understand and evaluate economic issues concerning the property construction sector at both a micro and macro level;
9. understand the time value of money;
10. communicate with clients and construction professional concerning spatial concepts, financial issues and construction assembly problems;
11. communicate effectively in writing and orally with superiors, peers and subordinates;
12. recognise the impact of construction activities on society and the environment;
13. function successfully in a multi-disciplinary team;
14. analyse and interpret data and derive information therefrom;
15. appreciate the value of and be able to work effectively and efficiently;
16. engage in lifelong leaning and recognise this as an important professional value;
17. recognise the need to act professionally and ethically within an area of competence;
18 apply appropriate project management and construction management techniques to building and civil engineering projects;
19 perform appropriate professional project and construction management functions;
20 identify, analyse and solve problems in the field of construction assembly and management of the process;
21 perform a number of potential roles within a constructor or project management organisation, after an appropriate period of practical experience;
22 undertake research and produce reports.

Associated Assessment Criteria
On completion of the BSc (Hons) in Construction Management, the learner 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 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.

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

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Bachelor of Science with Honours in Quantity Surveying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>BScHons(QS)</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>1 year full-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 7</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 120</td>
</tr>
</tbody>
</table>

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

1. identify, assess and solve open-ended quantity surveying/construction related problems creatively and innovatively within limits of own knowledge;
2. perform basic construction trade skills;
3. use computer packages for quantity surveying and construction related information processing;
4. manage and prepare tender and contractual documents relating to construction projects;
5. estimate cost and undertake financial management of construction developments;
6. manage the costs of the construction of buildings and related infrastructure;
7. manage the human resources within quantity surveying based organisations;
8. understand and evaluate economic issues concerning the property construction sector at both a micro and macro level;
9. understand the time value of money and apply discounted cash flow techniques for evaluating alternatives property investments;
10. communicate with clients and construction professionals concerning spatial concepts, financial issues and construction assembly problems;
11. communicate effectively in writing and orally with superiors, peers and subordinates;
12. recognise the impact of construction activities on society and the environment;
13. function successfully in a multi-disciplinary team;
14. analyse and interpret data and derive information therefrom;
15. appreciate the value of and be able to work effectively and efficiently;
16. engage in lifelong learning and recognise this as an important professional value;
17. recognise the need to act professionally and ethically within an area of competence;
18. undertake financial planning and control of new and existing facilities;
19. undertake property development and property portfolio management;
20. value property;
21. apply appropriate quantity surveying techniques to building and civil engineering projects;
22. perform appropriate professional quantity surveying management functions;
23. 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.
2.4 Bachelor of Science with Honours in Urban and Regional Planning [BScHons(URP)]

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Bachelor of Science with Honours in Urban and Regional Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>BScHons(URP)</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>1 year full-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 7</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 120</td>
</tr>
</tbody>
</table>

Note: Although many of the outcomes are similar to those in the BSc (URP) the learner 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 learner must meet the requirements of Exit Level Outcome 7.

Exit Level Outcome 1
The qualifying learner has an advanced integrative understanding of development and planning issues important to the South African context.

Associated Assessment Criteria
The qualifying learner 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 learner 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 learner 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 learner is able to cope with and plan within South Africa’s diverse social and cultural dynamics.

Associated Assessment Criteria
The qualifying learner 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 learner 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 learner 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 learner 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 learner 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 learner 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 learner 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 learners.
Exit Level Outcome 7
The qualifying learner 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 learner 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.

3. Degrees of Master
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 8
SAQA Credits
Total minimum 240

1
Exit Level Outcome
The learner 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 learner 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.

2
Exit Level Outcome
The learner is required to operate effectively in an academic environment with peers and supervisors. Where appropriate to the research area, the learner is required to interact effectively with communities and other groups and individuals outside the academic arena.

Associated Assessment Criteria
The learner demonstrates:
The importance of the exchange ideas and knowledge with peers and supervisors.
The learner 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
The learner is required to have extensive communication skills and the ability to produce material of an internationally acceptable standard.

Associated Assessment Criteria
The learner understands a wide range of strategies for communicating in the pursuit of data collection, and in the transmission of the results of research.

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

Exit Level Outcome
The learner will be able to locate his/her decision making and proposals within wider social, legal, economic, intellectual and environmental contexts.

Associated Assessment Criteria
The learner 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
The learner 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 learner shows time management, self-motivation, prioritisation and initiative at an advanced level.

7

Exit Level Outcome
The learner is required to have extensive skills and knowledge in the area of data collection, analysis, organisation and evaluation.

Associated Assessment Criteria
The learner 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 learner 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.

8

Exit Level Outcome
The learner is exposed to a range of sophisticated learning strategies, and is expected to make informed decisions on those employed.

The learner is required to act responsibly and professionally, with full regard to the needs and aspirations of the society within which s/he operates.

The learner has considerable cultural and aesthetic awareness, and is required to enhance and apply this within the area of specialisation.

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

Associated Assessment Criteria
The learner is able to operate effectively in a professional and academic environment.

The learner demonstrates:
• cultural and aesthetic awareness and sensitivity;
• a wide range of strategies in the pursuit of his/her studies.

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

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

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Master of Architecture (Professional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>MArch(Prof)</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>1 year full-time or 2 years part-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 8</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 180</td>
</tr>
</tbody>
</table>

Exit Level Outcome 1
The qualifying learner 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 learner:
• 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 learner 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 learner 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 learner shows design competencies at a range of different scales, from the urban, to the level of architectural detailing.

Associated Assessment Criteria
The qualifying learner 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 learner is familiar with current technological knowledge and is able to integrate it with design solutions.

Associated Assessment Criteria
The qualifying learner 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 learner is able to communicate appropriately and effectively.

**Associated Assessment Criteria**
The qualifying learner demonstrates skill at communicating ideas and information to people from a wide range of backgrounds:
• orally;
• in writing;
• graphically.

**Exit Level Outcome 6**
The learner 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 learner can:
• represent creative ideas, and
• produce technical drawings;
both
• manually, and
• using computer technology
innovatively and technically competently.

**Exit Level Outcome 7**
The qualifying learner demonstrates self-directed, independent thought and practice.

**Associated Assessment Criteria**
In order to perform adequately in addressing all facets of the programme the qualifying learner shows time management, prioritisation and initiative at a professional level. The qualifying learner is able to define, motivate and tackle problems with initiative and in an independent manner.

**Exit Level Outcome 8**
The qualifying learner has experience in group work with peers and is able to worked directly with outside parties in a professional manner.
Associated Assessment Criteria
The qualifying learner demonstrates professionalism in collaboration, group work and consultation with outside bodies.

Exit Level Outcome 9
The qualifying learner 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 learner 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 learner reflects and acts upon a wide range of learning strategies, both existing and innovative.

Associated Assessment Criteria
The qualifying learner 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 learner 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 learner 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 learner 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 learner will be equipped to develop entrepreneurial opportunities in a future career.

Associated Assessment Criteria
The qualifying learner demonstrates:
- initiative;
- independence of thought and action;
- communication and networking skills;
- an understanding of financial management and control in a professional situation.

3.3 Master of Engineering [MEng]

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Master of Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>MEng</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>1 year full-time or 2 years part-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 7 (A proviso set by the CHE for accreditation is that this Masters which is by coursework only, can therefore not exit at NQF level 8 since it has no research component)</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 180</td>
</tr>
</tbody>
</table>

1 Specialist knowledge

Exit Level Outcome
The qualifying learner is competent to apply specialist knowledge to engineering problems.

Associated Assessment Criteria
The qualifying learner 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 learner is competent to perform high order problem solving techniques.

Associated Assessment Criteria
The qualifying learner 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 learner is competent to apply specialised engineering tools and techniques.

Associated Assessment Criteria
The qualifying learner 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.

3.4 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

SAQA Credits
Total minimum 180

Exit Level Outcomes 1
The qualifying learner demonstrates ability to work independently and shows mastery in advanced study and research methods.

Associated Assessment Criteria
The qualifying learner 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 is competent to apply specialist knowledge to property finance, development, valuation and management problems.

Associated Assessment Criteria
The qualifying learner 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 learner is competent to perform high order problem solving techniques.

Associated Assessment Criteria
The qualifying learner 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 learner 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 learner 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.

3.5 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 8
SAQA Credits Total minimum 300

Exit Level Outcome 1
The learner is competent to identify, evaluate and solve problems within the ambit of the field of development planning. The learner is familiar with relevant theoretical paradigms, concepts and procedures.

Associated Assessment Criteria
The qualifying learner 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 learner has a knowledge of how to manage uncertainty within a changing temporal, socio-economic, political and environmental context.

Associated Assessment Criteria
The qualifying learner:
• 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 learner is able to cope with South Africa’s diverse social and cultural dynamics.

**Associated Assessment Criteria**
The qualifying learner 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 learner 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 learner:
• 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 learners.

**Exit level Outcome 5**
The qualifying learner 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 learner:
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 learner can research, analyse and interpret information in different ways and can communicate its significance to different types of audience.

Associated Assessment Criteria
The qualifying learner 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.

3.6 Master of Science in Engineering [MSc(Eng)]

<table>
<thead>
<tr>
<th>Qualification Title</th>
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</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>MSc(Eng)</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>1 year full-time or 2 years part-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 8</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 240</td>
</tr>
</tbody>
</table>

1 Research mastery

Exit Level Outcome
The qualifying learner demonstrates ability to work independently and shows mastery in advanced study and research methods.

Associated Assessment Criteria
The qualifying learner 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 learner is competent to apply specialist knowledge to engineering problems.
**Associated Assessment Criteria**
The qualifying learner 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 learner is competent to perform high order problem solving techniques

**Associated Assessment Criteria**
The qualifying learner 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 learner is competent to apply specialised engineering tools and techniques.

**Associated Assessment Criteria**
The qualifying learner 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.

3.7 **Master of Science in Quantity Surveying [MSc(QS)]**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>MSc(QS)</td>
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<tr>
<td>Minimum Period of Study</td>
<td>1 year full-time or 2 years part-time</td>
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<td>NQF Exit Level</td>
<td>Level 8</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 240</td>
</tr>
</tbody>
</table>

**Exit Level Outcome 1**
The qualifying learner 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 learner is familiar with relevant theoretical material for the area in which s/he is specialising.
Associated Assessment Criteria
The qualifying learner 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 learner is required to operate effectively in an academic environment with peers and supervisors. Where appropriate to the research area, the learner is required to interact effectively with communities and other groups and individuals outside the academic arena.

Associated Assessment Criteria
The qualifying learner 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 learner is required to have extensive communication skills and the ability to produce material of an internationally acceptable standard.

Associated Assessment Criteria
The qualifying learner 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 learner 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 learner 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 learner 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 learner 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 learner 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 learner demonstrates responsibility in respect of time management, self-motivation, prioritisation and initiative at an advanced level.

**Exit Level Outcome 7**
The qualifying learner is required to have extensive skills and knowledge in the area of data collection, analysis, organisation and evaluation.

**Associated Assessment Criteria**
The qualifying learner 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 learner 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 learner is exposed to career opportunities both within an entrepreneurial and academic context.

**Associated Assessment Criteria**
The qualifying learner 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.
3.8 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 8
SAQA Credits Total minimum 240

Exit Level Outcome 1
The qualifying learner 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 learner 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 learner is required to operate effectively in an academic environment with peers and supervisors. Where appropriate to the research area, the learner is required to interact effectively with communities and other groups and individuals outside the academic arena.

Associated Assessment Criteria
The qualifying learner 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 learner is required to have extensive communication skills and the ability to produce material of an internationally acceptable standard.

Associated Assessment Criteria
The qualifying learner 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 learner 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 learner 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 learner 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 learner 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 learner will have developed a high level of self-management with a critical awareness of personal values.

Associated Assessment Criteria
The qualifying learner 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 learner is required to have extensive skills and knowledge in the area of data collection, analysis, organisation, interpretation and application.

Associated Assessment Criteria
The qualifying learner 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 learner 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 learner has considerable cultural and environmental awareness, and is required to enhance and apply this within the area of specialisation. The qualifying learner is exposed to career opportunities both within an entrepreneurial and an academic context.

**Associated Assessment Criteria**
The qualifying learner 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.

### 3.9 Master of the Built Environment [MBE]

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Master of the Built Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>MBE</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>1 year full-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>HEQF Level 9</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>180</td>
</tr>
</tbody>
</table>

**Exit Level Outcome 1**
The qualifying learner 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 learner is competent to critically analyse the interaction between the housing, the social/cultural, economic and biophysical environment.

**Associated Assessment Criteria**
The qualifying learner 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 learner understands and is competent to analyse existing and proposed legal and financial frameworks.

**Associated Assessment Criteria**
The qualifying learner 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 learner 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 learner 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 learner 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 learner 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.

3.10 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 8
SAQA Credits Total minimum 240

Exit Level Outcome 1
The qualifying learner 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 learner 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 learner 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 learner is able to work in and lead a group in a range of situations, showing leadership qualities.
Exit Level Outcome 3
The qualifying learner 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 learner shows time management, self-motivation, prioritisation and initiative at an advanced level.

Exit Level Outcome 4
The qualifying learner 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 learner 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 learner 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 learner 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 learner 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 learner has
- a wide knowledge of the diverse use of technology related to the specialisation;
- technological competence and understanding.

The learner 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 learner 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 learner 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 learner is exposed to a range of sophisticated learning strategies, and is expected to make informed decisions on those employed.

Associated Assessment Criteria
The qualifying learner demonstrates the ability to operate effectively in a professional and academic environment. The learner 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 learner 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 learner demonstrates the ability to:
• work in professional teams;
• work across disciplinary boundaries;
The learner 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 learner has considerable cultural and aesthetic awareness, and is required to enhance and apply this within the area of specialisation.

Associated Assessment Criteria
The qualifying learner demonstrates cultural and aesthetic awareness and sensitivity.

Exit Level Outcome 11
The qualifying learner is exposed to career opportunities both within an entrepreneurial and academic context.

Associated Assessment Criteria
The qualifying learner demonstrates awareness of career opportunities open to him/her in both an academic and entrepreneurial context.

Exit Level Outcome 12
The qualifying learner exhibits the capacity for critical, independent thought.

Associated Assessment Criteria
The qualifying learner demonstrates the ability to think, respond and make decisions critically and analytically.
### 3.11 Master of Urban Studies [MUS]

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Master of Urban Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>MUS</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>1 year full-time or 2 years part-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 8</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 240</td>
</tr>
</tbody>
</table>

**Exit Level Outcome 1**

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

**Associated Assessment Criteria**

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

**Associated Assessment Criteria**

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

Associated Assessment Criteria
The qualifying learner 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 learner is required to have extensive skills and knowledge in the area of data collection, analysis, organisation, interpretation and application.

Associated Assessment Criteria
The qualifying learner 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 learner 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 learner has considerable cultural and environmental awareness, and is required to enhance and apply this within the area of specialisation. The qualifying learner is exposed to career opportunities both within an entrepreneurial and an academic context.
**Associated Assessment Criteria**
The qualifying learner 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. Doctoral Degrees**

**4.1 Doctor of Philosophy [PhD]**

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Doctor of Philosophy</th>
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<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>PhD</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>2 years full-time or 4 years part-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 10</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 360</td>
</tr>
</tbody>
</table>

**Exit Level Outcome 1**
The qualifying learner is capable of independent and original research.

**Associated Assessment Criteria**
The qualifying learner 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 learner possesses highly specialised, authoritative knowledge and is competent to apply that knowledge to the solution of problems.

**Associated Assessment Criteria**
The qualifying learner 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 learner is self-directed and self-critical.

**Associated Assessment Criteria**
The qualifying learner 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.

5. **Senior Doctoral Degrees**

5.1 **Doctor of Architecture [DArch]**

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Doctor of Architecture</th>
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<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>DArch</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>n/a (published work)</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 10</td>
</tr>
</tbody>
</table>

**Exit Level Outcomes**

1. The qualifying learner demonstrates, through the cumulative impact of original work of publishable standard, a distinguished contribution to knowledge.
2. The qualifying learner 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 learner has produced a substantial and co-ordinated body of distinguished original work, of publishable standard, for assessment.

5.2 **Doctor of Engineering [DEng]**

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Doctor of Engineering</th>
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<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>Deng</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>n/a (published work)</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 10</td>
</tr>
</tbody>
</table>

**Exit Level Outcomes**

Learners are required to be able to:

1. access and process information responsibly using a range of technologies;
2. communicate and produce information responsibly using a range of technologies;
3. critically analyse and problem solve;
4. demonstrate a thorough knowledge of methods and relevant literature appropriate to engineering development and a mastery of relevant techniques;
5. contribute substantial and original work in the field of engineering;
6. show understanding of their ethical obligations;
7. assess the significance of the developments and their application in engineering practice;
8. 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 learner.
5.3 **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 10

**Exit Level Outcomes**
Learners are required to be able to:

1. access and process information responsibly using a range of technologies;
2. communicate and produce information responsibly using a range of technologies;
3. critically analyse and problem solve;
4. demonstrate a thorough knowledge of methods and relevant literature appropriate to research and a mastery of relevant techniques;
5. contribute substantial and original work to the international body of knowledge in their field;
6. show understanding of their ethical obligations;
7. assess the significance of their work;
8. 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 learner.

5.4 **Doctor of Urban and Regional Planning [D(URP)]**

**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

**Exit Level Outcomes**
1. The qualifying learner demonstrates, through the cumulative impact of original work of publishable standard, a distinguished contribution to knowledge.
2. The qualifying learner 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 learner has produced a substantial and co-ordinated body of distinguished original work, of publishable standard, for assessment.
5.5 **Doctor of Science in Architecture [DSc(Arch)]**

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Doctor of Science in Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>DSc(Arch)</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>n/a (published work)</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 10</td>
</tr>
</tbody>
</table>

**Exit Level Outcomes**

1. The qualifying learner demonstrates, through the cumulative impact of original work of publishable standard, a distinguished contribution to knowledge.
2. The qualifying learner 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 learner has produced a substantial and co-ordinated body of distinguished original work, of publishable standard, for assessment.

5.6 **Doctor of Science in Building [DSc(Building)]**

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Doctor of Science in Building</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>DSc(Building)</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>n/a (published work)</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 10</td>
</tr>
</tbody>
</table>

**Exit Level Outcomes**

1. The qualifying learner demonstrates, through the cumulative impact of original work of publishable standard, a distinguished contribution to knowledge.
2. The qualifying learner 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 learner has produced a substantial and co-ordinated body of distinguished original work, of publishable standard, for assessment.

5.7 **Doctor of Science in Quantity Surveying [DSc(QS)]**

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Doctor of Science in Quantity Surveying</th>
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<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>DSc(QS)</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>n/a (published work)</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 10</td>
</tr>
</tbody>
</table>

**Exit Level Outcomes**

1. The qualifying learner demonstrates, through the cumulative impact of original work of publishable standard, a distinguished contribution to knowledge.
2. The qualifying learner 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 learner has produced a substantial and co-ordinated body of distinguished original work, of publishable standard, for assessment.
5.8 **Doctor of Science in Urban and Regional Planning (DSc(URP))]**

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Doctor of Science in Urban and Regional Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>DSc(URP)</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>n/a (published work)</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 10</td>
</tr>
</tbody>
</table>

**Exit Level Outcomes**

1. The qualifying learner demonstrates, through the cumulative impact of original work of publishable standard, a distinguished contribution to knowledge.
2. The qualifying learner 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 learner has produced a substantial and co-ordinated body of distinguished original work, of publishable standard, for assessment.

6. **Diplomas**

6.1 **Postgraduate Diploma in Engineering (PGDip(Eng))]**

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Postgraduate Diploma in Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>PGDip(Eng)</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>1 year full-time or 2 years part-time</td>
</tr>
<tr>
<td>NQF Exit Level</td>
<td>Level 8</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 120</td>
</tr>
</tbody>
</table>

1. **Specialist knowledge**

**Exit Level Outcome**

The qualifying learner is competent to apply specialist knowledge to engineering problems.

**Associated Assessment Criteria**

The qualifying learner 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 learner is competent to perform high order problem solving techniques.
Associated Assessment Criteria
The qualifying learner 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 learner is competent to apply specialised engineering tools and techniques

Associated Assessment Criteria
The qualifying learner 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.

6.2 Postgraduate Diploma in Planning [PGDipPlanning]

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Postgraduate Diploma in Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>PGDipPlanning</td>
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<tr>
<td>Minimum Period of Study</td>
<td>1 year full-time</td>
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<tr>
<td>NQF Exit Level</td>
<td>Level 7</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 120</td>
</tr>
</tbody>
</table>

Exit Level Outcome 1
The learner is competent to identify, evaluate and solve problems within the ambit of the field of development planning. The learner is familiar with relevant theoretical paradigms, concepts and procedures.

Associated Assessment Criteria
The qualifying learner 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 learner has been exposed to the management of uncertainty within a changing temporal, socio-economic, political and environmental context.

Associated Assessment Criteria
The qualifying learner:
- is aware of how to identify and address complex problems by employing - appropriate planning theories,
- concepts, and
- quantitative or other planning techniques,
in dealing with such complex problems;
demonstrates individual skills in the investigation of fundamental areas of development 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 and cultural issues affecting the physical and natural urban or rural environment.

Exit Level Outcome 3
The qualifying learner is able to cope with South Africa’s diverse social and cultural dynamics.

Associated Assessment Criteria
The qualifying learner is competent in group work, notably with peers, and can perform
• multi-disciplinary team work;
• certain aspects of field research;
• academic exercises and planning work;
demonstrating the skills required in dealing with the complexities of such work.

Exit Level Outcome 4
The qualifying learner is able to operate under supervision in a normal range of development planning situations.

Associated Assessment Criteria
The qualifying learner:
• understands how a framework of facilities affects 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 a given programme.

Exit level Outcome 5
The qualifying learner understands planning as part of wider social, political, cultural, administrative, economic and natural systems, and their dominant operating and financial characteristics.

Associated Assessment Criteria
The qualifying learner:
• demonstrates a knowledge of the structural and operating characteristics of infra-structural and other systems and the limitations these impose on development;
• is familiar with a range of possible relationships between planning and society;
• shows critical, analytical and creative thinking abilities in applying the existing body of knowledge and understanding in planning to specific problem categories.

Exit Level Outcome 6
The qualifying learner can investigate, analyse and interpret information in different ways and can communicate its significance to different types of audience.

Associated Assessment Criteria
The qualifying learner uses
Outcomes for Engineering and the Built Environment

- writing, visual, graphic, mathematical and verbal skills in thinking and communicating;
- IT 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 interpret and evaluate certain research materials.

Exit Level Outcome 7
The qualifying learner has been prepared for the next stage of his/her career, whether in an academic, entrepreneurial or community context, and to meet the demands of lifelong development.

Associated Assessment Criteria
The qualifying learner will have 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 learners.

6.3 Postgraduate Diploma in Property Development and Management [PGDipPDM]

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Postgraduate Diploma in Property Development and Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification Abbreviation</td>
<td>PGDip. (Property Development &amp; Management)</td>
</tr>
<tr>
<td>Minimum Period of Study</td>
<td>1 year full-time / 2 years part-time</td>
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<tr>
<td>NQF Exit Level</td>
<td>Level 8</td>
</tr>
<tr>
<td>SAQA Credits</td>
<td>Total minimum 120</td>
</tr>
</tbody>
</table>

Exit Level Outcome 1
The qualifying learner demonstrates ability to work independently and shows mastery in advanced study and research methods.

Associated Assessment Criteria
The qualifying learner 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 learner 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 learner is competent to perform high order problem solving techniques.

Associated Assessment Criteria
The qualifying learner 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 learner 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 learner 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.
The order of the courses is based on the following scheme:

a) In alphabetical order by school offering the course.

b) 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.

SCHOOL OF ANATOMICAL SCIENCES

ANAT2020A Anatomy

(48) (3.5-1-3) (2 terms)

This 200 hour core course extends over one academic year. It will lead to an understanding of the structure and function of the human body.

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, radiological anatomy, growth and evolution.

Histology

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, 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

BIOL1000A Introductory Life Sciences I

(36) (5-0-2) (2 terms)

This course is to be the core course for most of the disciplines offered at second- and third- year level in the Biological Sciences. It comprises the four topics listed below.

SCHOOL OF ARCHITECTURE AND PLANNING

ARPL1000  Architectural Design and Theory I
Qualifying course for BAS (60 SAQA points)

Design component: Introduction to design and studio, a series of exercises, applying design fundamentals, a sequence of interrelated exercises leading to designing a building.

Theory component: Introduction to architectural elements, thematically tackled, through a range of architectural projects; and applied in the design projects.

ARPL1001  Theory and Practice of Construction I
Qualifying course for BAS (20 SAQA points)

Introduction to basic building technology, materials and National Building Regulations. Roles and responsibilities of architects. Introduction to technical drawing. Building processes in domestic contexts, elementary services of water supply, sewerage reticulation and electrical supply. Introduction to topography, basic survey techniques and soil conditions. Services related to specific soil conditions.

ARPL1002  Introduction to Structures
Qualifying course for BAS (5 SAQA points)

Introduction to the relationships between architectural forms and structural systems. Studies of 19th and 20th century structures that have influenced subsequent architectural design significantly.

ARPL1003  Architectural Representation I
Qualifying course for BAS (15 SAQA points)

This course is divided into three components each with its own curriculum.

Graphics
Introduction to the principles and conventions of architectural representation. Hand drawing, painting, 3D construction techniques, and computer graphics instruct students about the array of graphic communication tools.

Descriptive geometry
The principles and fundamentals of descriptive geometry and three dimensional drawing. Measured and freehand perspective drawing.

Computers
Introduction to computer graphics and two-dimensional computer design.

ARPL1006A  The Southern African City through History
Qualifying course for BSc(URP)

This course provides a comparative perspective on the development of major cities in Southern Africa, and traces the many forces that have shaped and are currently shaping these cities. These include: the nature of the physical environment, politics and ideology, interventions by government, and market processes.

ARPL1010  Planning for Property Developers
Qualifying course for BSc(Property Studies)

This course will include an introduction to: theories of planning and of planning process; the relationship between planning and the property market; planning law and systems of planning in South Africa that impact on property development; integrated development planning; land use management including zoning schemes; environmental impact
assessments, spatial development frameworks, local economic development, inner-city regeneration, urban decentralisation, and edge city development.

**ARPL1013 Histories and Theories of Architecture I**
Qualifying course for BAS (15 SAQA points)
An introduction to world architecture from ancient to modern times.

**ARPL1014A Settlements through History**
Qualifying course for BSc(URP)
The course provides an introduction to the evolution of human settlement through history around the world. It presents human settlements as ever-changing cultural constructs that are always open to new interpretation and understanding. The course will include an African perspective on settlement by specifically focusing on Southern Africa and tracing the many forces that have shaped and are currently shaping course also aims to develop students’ theoretical skills and writing abilities.

**ARPL1015A Introduction to Environmental Interpretation**
Qualifying course for BSc(URP)
This is a project-based course that 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 will also introduce learners to different living environments shaped within different cultural contexts. The course includes a project that will introduce the learner to graphic and other visual skills that are used in interpreting settlements and presenting plans.

**ARPL1016A Introduction to Settlement Form and Design**
Qualifying course for BSc(URP)
This course provides an introduction to different types of settlements in urban and rural areas, and to the shape (or morphology) of these settlements. It also introduces the idea of urban environmental design, and to the various elements that comprise a settlement. The course introduces students to different urban components and basic design elements with a focus on the development of graphic communication. The course introduces the application of digital technologies appropriate to this level of study. The course is project-based.

**ARPL1025A Two and Three Dimensional Computer Aided Design and GIS**
Qualifying course for (BSc URP)
This course taken in the second year of study, is an introduction to Computer Aided Design (CAD) and GIS and will require students to use the tools, techniques and technologies taught in this course for practical application in their courses and projects.

**ARPL2000 Architectural Design and Theory II**
Qualifying course for BAS (60 SAQA points)
Design component
The private and public realm - residential, community and institutional buildings in a range of contexts exploring simple and complex architectural forms and space making.
Theory component
Place making in different social and cultural contexts; building methods; architecture and community; introduction to urbanism; urban morphology and architectural typology.
ARPL2002 Theory and Practice of Construction II

Qualifying course for BAS (20 SAQA points)


Building climate: thermal concepts and principles; passive and active energy system; use of solar charts and shading diagrams.

Introduction to a range of building materials and structural systems. Services – plumbing, fire and electrical reticulation. Relevant National Building Regulations. Design development and the preparation of technical documentation.

ARPL2003 Architectural Representation II

Qualifying course for BAS (15 SAQA points)

The course is divided into two components each with its own curriculum:

Graphics

Advanced utilization of the tools and techniques of computer graphic programmes. Elective courses in photography, furniture making and model building.

Computers

Advanced two and three dimensional computer aided design.

ARPL2006A Planning for Housing, Services, Infrastructure and Transport

Qualifying course for BSc(URP)

This course introduces students to: 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. These issues are dealt with in relation to both rural and urban areas.

ARPL2012 Histories and Theories of Architecture II

Qualifying course for BAS (15 SAQA points)

Detailed study concentrating on four distinct periods in the history and theory of architecture (for example: Nubian Architecture, Ottoman Empire, 16th C Florence, Meiji Japan, French Enlightenment, 19th & 20th C West African Architecture, etc.).

ARPL2013A Introduction to Land Management

Qualifying course for BSc(URP)

The course provides an introduction to land management incorporating: 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 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.
ARPL2015A Contemporary Design and Environmental Issues in South Africa

Qualifying course for BSc(URP)

This course deals with concepts of: livability 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.

ARPL 2017A Histories, Theories and Futures of Planning

Qualifying course for BSc(URP)

The unit introduces students to the idea and practice of planning as it evolved from the nineteenth century to the present day in South Africa and internationally. The unit also provides different histories of planning, illustrating both its successes and failures and the extent to which it has been shaped different contexts and factors. Furthermore, the unit will consider the intellectual basis of planning and the developments regarding theory from modernism, pragmatism, post-modernism and the impacts of collaborative and insurgent planning. It will further question these international histories and theories from a South African perspective, examining changes in planning and the city from apartheid to post-apartheid contexts. The course essentially seeks to link theoretical developments with practice situations and attempts to apply theoretical understandings of cities in practice.

ARPL 2018A Introduction to Environmental Planning

Qualifying course for BSc(URP)

The course provides a critical perspective on the notions of “the environment,” “sustainability,” “sustainable development” and the “sustainable city.” The course then focuses on the relationship between the environment and urban development. The course includes an introduction to: the fundamentals of ecology; the notions of sustainability, and sustainable development; and, inter alia, the overall concepts of and tools associated with Environmental Assessment (EA), Integrated Environmental Management (IEM) and Strategic Environmental Assessment (SEA). The course will provide practical applications of the principles of sustainable development in terms of a spatially oriented project.

ARPL3002 Small Office Practice

Qualifying course for BAS (5 SAQA points)

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, marketing professional services.

ARPL3005 Architectural Design and Theory III

Qualifying course for BAS (60 SAQA points)

Design component

Complex design exercises with an emphasis on large scale, a major project, integrating theory, design and technology.
Theory component
Contemporary issues in architecture, thematically tackled, through a range of illustrative contemporary architectural projects.

**ARPL3010A  Comparative Planning Systems**

Qualifying course for BSc(URP)
This course deals with the 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.

**ARPL3012A  Comparative Approaches to Urban Design**

Qualifying course for BSc(URP)
This course will provide learners with the theoretical basis for designing within a contemporary context. It will introduce learners to the economic, social and political factors that influence design at different scales. Issues that will be addressed 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. This course will focus 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 will include the use of appropriate digital technologies.

**ARPL3013A  Housing Theory, Law and Policy**

Qualifying course for BSc(URP)
This course addresses: 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.

**ARPL3017  Architectural Design and Theory IIIA**

Occasional course only (30 SAQA points)
The course is divided into two components, each with its own syllabus [NB: these components are taught in parallel and not one after the other].

Architectural Design (75%)
Complex design exercises with an emphasis on large scale, contemporary commercial, industrial or corporate types.

Architectural Theory (25%)
Contemporary issues in architecture, thematically tackled, through a range of illustrative contemporary architectural projects.

**ARPL3018  Architectural Design and Theory IIIB**

Occasional course only (30 SAQA points)
The course is divided into two components, each with its own syllabus [NB: these components are taught in parallel and not one after the other].

Architectural Design (75%)
Complex design exercises; a major project, integrating theory, design and technology.
Architectural Theory (25%)
Further contemporary issues in architecture, thematically tackled, through a range of illustrative contemporary architectural projects.

**ARPL3019 Theory and Practice of Construction IIIA**
Occasional course only (15 SAQA points)
Services, building infrastructure. Introduction to industrialized building systems. Introduction to specifications. Introduction to complex building construction, specifications and working drawings.

**ARPL3020 Theory and Practice of Construction IIIB**
Occasional course only (15 SAQA points)
Further consideration of services. Relevant National Building Regulations. “High-tech” construction, air-conditioning, acoustics, advanced specifications, developed working drawings.

**ARPL3021 Histories and Theories of Architecture III**
Qualifying course for BAS (15 SAQA points)
The study of histories and theories of architecture that have had a substantial influence on contemporary debates and current forms of practice.

**ARPL3023A Politics, Governance and the City**
Qualifying course for BSc(URP)
Who governs in contemporary cities? How are decisions regarding urban policies and urban projects made and implemented? What is the role of business in setting the urban strategic agenda? What is the power of residents’ associations and civics to have their voice heard in urban governance? The objective of this course is to provide students with theoretical as well as practical responses to this type of questions. Theories of urban regimes, urban governance, participation, social movements and political mobilization will be presented and their relevance for African cities debated through different case studies.

**ARPL3024 Histories and Theories of Architecture IIIA**
Occasional course only (7.5 SAQA points)
The study of histories and theories of architecture that have had a substantial influence on contemporary debates and current forms of practice.

**ARPL3025 Histories and Theories of Architecture IIIB**
Occasional course only (7.5 SAQA points)
The study of histories and theories of architecture that have had a substantial influence on contemporary debates and current forms of practice.

**ARPL3026A Integrated Development Planning**
Qualifying course for BSc(URP)
This course has a theoretical and practical component. The theory deals with: different approaches to integrated planning, international precedent, planning in relation to 'developmental local government', and 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. The practical component consists of a project that introduces students to the IDP process; the integration of planning and
institutional processes; and 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. Critical engagement with the regional context, key issues and relevant development approaches will situate the project within a broader conceptual framework drawn from international and local literature.

**ARPL3027A Regional Planning and Local Economic Development**

Qualifying course for BSc(URP)

This course introduces students to planning at supra-local scales (i.e., 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. While 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, the course largely focuses attention on contemporary approaches.

**ARPL3028A Development Policy and Processes in South Africa**

Qualifying course for BSc(URP)

This unit 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 also 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.

**ARPL3029A Spatial and Design Principles**

Qualifying course for BSc(URP)

This unit introduces the fundamental body of design principles that are archetypal. It demonstrates how those principles create unique and profound physical and social form as they become integrated within a broad range of specific cultures, buildings and physical settings. It offers a structure of principles 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 organizing space; the need for spatial structure that will remain useful and meaningful over time. The course also emphases place making in different social and cultural contexts. There is application of planning graphic communication and technologies.

**ARPL3030A Applications in Graphic and Spatial Communication in Planning**

Qualifying course for BSc(URP)

This unit requires students to apply the use of mapping, graphic and presentation tools/techniques acquired in previous years. It also introduces and develops the skills of plan and framework interpretation at various scales ranging from the precinct and ward levels to national scales. Content also 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.

**ARPL3031  Theory and Practice of Construction III**  
Qualifying course for BAS  
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. Application and adherence to the relevant National Building Regulations including SANS10400. Introduction to industrialized building systems. Introduction to specifications. Approaches to environmental control and performance modelling. Preparation of detailed technical documentation.

**Postgraduate courses**

**ARPL4000A  Advanced Design Studio**  
Qualifying course for BAS(Hons)  
Studio course addressing an aspect of contemporary architectural and/or urban design.

**ARPL4001A  Design Studio**  
Qualifying course for BAS(Hons)  
Contemporary design studio in the fields of housing, urban design or architecture.

**ARPL4002A  Contemporary Architectural Theory**  
Qualifying course for BAS(Hons)  
Theoretical readings of and research into architecture drawn from the fields of critical theory, cultural studies, gender studies, urban studies, postcolonial theory etc. Research methods.

**ARPL4003A  Advanced Theory and Practice of Construction**  
Qualifying course for BAS(Hons)  
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. Research methods.

**ARPL4004A  Advanced History of Architecture and Urbanism**  
Qualifying course for BAS(Hons)  
Interrogation of modern architecture and urbanism, with an emphasis on the developing world; comparisons between local and other international contexts. Historical research methods.
ARPL4005A  Research Project

Qualifying course for BAS(Hons)

Research in a particular field of architecture: history/ technology/ theory or professional practice, including field, archival and /or laboratory work.

ARPL4014A  Advanced Planning Thought

Qualifying course for BSc(Hons)(URP)

This seminar-based course revisits the ‘philosophies and theories of planning’. It provides learners with an opportunity to engage in in-depth reading of planning theory, and to explore the links between social, economic and political theories and various forms of planning practice.

ARPL4026A  Planning Law and Professional Practice and Ethics

Qualifying course for BSc(Hons)(URP)

This course addresses: the historical development of the planning profession; debates around the concept of professionalism; professional bodies; professional ethics; forms of practice (in public and private sectors). The law component is an introduction to law and the legal system in South Africa, before focussing on key pieces of national and provincial legislation that are related to development planning. This may include legislation dealing with: spatial development, environmental management, housing, local government, and land reform. This course provides learners with an understanding of the legal system in South Africa, and those key pieces of legislation that affect planning. It includes discussion of: the South African constitution and its implications for planning; national legislation around planning (e.g. the Development Facilitation Act); local government legislation and planning (e.g. the Municipal SystemsAct); sectoral legislation and planning (w.r.t transport, environment, land reform); and, provincial legislation (e.g. the Gauteng Planning and Development Act).

ARPL4027A  Integrated Planning Project

Qualifying course for BSc(Hons)(URP)

This project will allow the learner to bring together and consolidate an understanding of the many different aspects of planning he or she has been introduced to. This is an integrative project that deals with the preparation of a spatial framework to co-ordinate development across sectors, and to promote sustainable development within a locality or region and may cut across a range of spatial scales.

ARPL4028A  Research Design for Planners

Qualifying course for BSc(Hons)(URP)

In this course, students develop and write a proposal which will form the basis for their research report. The course will identify and explain the principles behind formulating a planning research problem or issue, generating clear research aims and questions, formulating a conceptual framework based on planning theories and concepts. The course will expose students to the range of methodological approaches and identify those research methods appropriate to their own research, the process of fieldwork and the formulation of proposals/conclusions.
ARPL4029A  Research Report  
Qualifying course for BSc(Hons)(URP)
This course provides the learner 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. It requires learners to undertake research on a defined topic, to review the relevant literature; apply an appropriate conceptual framework and research methods; analyse their findings; and develop conclusions and recommendations based on their research.

(All courses listed from this point are 20 credits unless otherwise indicated)

ARPL5004  Cities, Development and Planning  
Qualifying course for PGDip (Planning)
This course explores the main dynamics and processes shaping cities in the contemporary era and the key challenges they face. It considers the 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. The course examines both the international literature and the literature in the South African context.

ARPL5005  Spatial Planning, Transport and Infrastructure (30 Points)  
Qualifying course for PGDip (Planning)
This is a lecture-based course with a major project. This course has two broad components.

The first component introduces students to spatial planning processes. This component focuses on spatial concepts and principles of spatial planning, as well as various processes and theories of spatial change. The course includes the development of a local level spatial plan, including spatial analysis, spatial policies, design and implementation. It will also include issues such as land tenure, settlement layout and morphology and land use management.

The second component deals with sustainable transportation and infrastructure.
Sustainable transport will introduce 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, stormwater and waste water provision as well as roads and sidewalk construction. This aspect will also deal with the relationship between urban form and infrastructure provision in terms of sustainable infrastructure, and costings.

ARPL5006  Planning Law and Professional Practice  
(30 points)  
Qualifying course for PGDip (Planning)
This unit addresses: the historical development of the planning profession; debates around the concept of professionalism; professional bodies; professional ethics; forms of practice (in public and private sectors). The law component is an introduction to law and the legal system in South Africa, before focussing on key pieces of national and provincial legislation that are related to development planning. This may include legislation dealing with: spatial development, environmental management, housing, local government, and land reform. This unit provides learners with an understanding of the legal system in
South Africa, and those key pieces of legislation that affect planning. It includes discussion of: the South African constitution and its implications for planning; national legislation around planning (e.g. the Development Facilitation Act); local government legislation and planning (e.g. the Municipal Systems Act); sectoral legislation and planning (w.r.t transport, environment, land reform); and, provincial legislation (e.g. the Gauteng Planning and Development Act).

**ARPL5007 Technologies and Techniques of Planning**

*(10 Points)*

Qualifying course for PGDip (Planning)

The course provides an introduction to procedural and analytical techniques used in planning. This course involves the practical application of appropriate technologies, including Geographic Information Systems (GIS), Internet, and computer packages for data analysis and the presentation of graphics.

**ARPL5008 Planning, Environment and Sustainability**

Qualifying course for PGDip (Planning)

This course has two components. The first introduces and provides a critical perspective on the concepts of sustainability and sustainable development. It also deals with the notion of the “sustainable city.” The second component deals with environmental planning. It introduces learners to ecological fundamentals, environmental ethics, the idea of environmental risk and the basics of environmental and resource economics. Thereafter the course deals with various forms of environmental management and planning, including Environmental Impact Assessment (EIA), Integrated Environmental Management (IEM), and Strategic Environmental Assessment (SEA).

**ARPL5009 Urban and Regional Economic Development**

Qualifying course for PGDip (Planning)

The course provides students with concepts, knowledge, and tools in economic development for analysing and understanding the dynamics of local and regional economic development. The unit engages theoretical approaches for the understanding of urban economics, local economic development and regional development. Students learn to appreciate the dynamics of location, distribution and spatial organization of economic activities and their implications for the configuration of urban forms and human development at local, regional and national levels.

**ARPL5010 Integrated Development Planning**

Qualifying course for PGDip (Planning)

This course has a theoretical and practical component. The theory deals with different approaches to integrated planning, international precedent, planning in relation to ‘developmental local government’, and 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. The practical component consists of a project that introduces students to the IDP process; the integration of planning and institutional processes; and 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. Critical engagement with the regional context, key issues and relevant development approaches will situate the project within a broader conceptual framework drawn from international and local literature.
ARPL7001A Advanced Digital Applications (9 points)

Introduction to specialised computer applications appropriate to architecture, e.g. desktop publishing, programmes for specialised technical analysis, programmes for specialised research, professional practice, etc.

ARPL7002A Simulated Office Practice (45 points)

Applying the principles of professional practice in the context of a functioning simulated office: 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.

ARPL7003A Architectural Design and Discourse (90 points)

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.

ARPL7004A Housing Theories, Concepts and Policy

This course will enable the qualifier to cite and analyse key local and international theories, concepts and ideas in the field of housing; to develop theoretical and conceptual frameworks and apply these to housing policy and practice; and to critically evaluate existing policy and develop new policy. The course covers theories relevant to an understanding of housing (its production and its inadequacies, including informal/illegal housing), including neo-Marxism/Structuralism, Political Economy, Liberalism, Positivism/Modernisation, Structure and Agency. The course discusses concepts that are 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. The course critically addresses international shifts in housing policy since the 1960s, the role of organisations such as the World Bank and the United Nations, including shifts in the roles assigned to Local Government; shifts in South African housing policy and their socio-political and economic underpinnings; and a comparative understanding of policy shifts in other developing countries.

ARPL7005A Social and Technical Sustainability in Housing

This seminar-based course will enable qualifiers 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. The course will help the student 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, the course will help the student understand decision-making and strategy prioritisation for sustainability in housing. The content of the course will include 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 will cover conceptual and theoretical debates as well as practical approaches that have been developed in response to these problems. The importance of inter-sectoral interventions will be discussed.

**ARPL7006A Advanced Housing Finance**

This course will enable the qualifying student to engage with housing finance challenges at an advanced level and from a well-developed theoretical and conceptual position. The course builds on the courses ‘Housing Finance and Law’ and ‘Housing Construction Technology and Management’. The course engages critically with the positions of international agencies, governments, banks, developers, civic organisations/civil society and end-users. It involves an advanced discussion of the sources of housing finance and the need for housing policy to integrate these. The course critically addresses various models for the structuring and release of government resources or subsidies (including participatory budgeting), private sector finance, end-user finance, credit and savings mechanisms. The course will identify, unpack and address gaps and blockages in housing finance for different sectors of society.

The advanced engagement with housing finance challenges will be based on an understanding of cost factors relating to housing provision in different contexts, and the practical aspects of design, procurement and cost planning. The course critically considers the relationship between housing finance on the one hand and the nature of the built environment and living conditions on the other hand. This includes engagement with 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.

**ARPL7007A Housing Seminar**

This seminar based course will enable the qualifying student to undertake analysis, synthesis and application in an area of housing specialisation, be it socio-cultural, managerial, financial, planning or design, and thus to engage with complex housing challenges and identify and solve complex problems by developing theoretically grounded reflected approaches. The course will expose the student to contemporary cutting edge issues in housing, that fall outside of the compulsory coursework. The course will expose the student to new, emerging thinking locally and internationally.

**ARPL7010A Understanding Cities of the South**

Understanding the many forces that shape cities of the south. These include 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.) as well as the discourses of modernity, globalisation and post-colonialism.

**ARPL7011A Urban Design Theory and History**

Urban design paradigms and theories; urban morphologies, including that of premodern, modern, colonial and post-colonial cities, focusing on cities of the south.
ARPL7029 Philosophies, Theories and Methodologies of Development Planning

This course has two components. The first introduces students 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. The second component provides the student with an overview of the theories and philosophies of planning. These include: procedural rationalism, neo-Marxist critique, and post-positivist philosophies that focus on issues such as power and communication.

ARPL7030A Municipal Planning

This course deals with municipal planning within the context of ‘developmental local governance’. It deals with: 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; and, performance management. The course will be linked to a project, and may include a service learning component.

ARPL7034A Specialised Topics in Planning

This course deals with a range of theories relevant to understanding specialised topics in the planning field.

ARPL7040A Research Methods (10 points)

The course familiarises the learner with research methods, articulation of research questions and identification of types of data (qualitative or quantitative). This leads to the different methods of data collection, with an additional emphasis on conducting surveys. The course covers approaches to analysing both qualitative and quantitative data. In particular, the learner will gain an applied understanding of statistics in analysis of quantitative data through the use of statistical programs.

ARPL7041A Architectural Professional Practice (36 points)

Managing medium to large-scale complex building projects, from inception to completion; including 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. The law in relation to architectural practice: environment; conservation; heritage, general principles of contract, company law and partnership, tax law. Protection of property rights. Professional responsibilities.

ARPL7044A Community Participation in Urban Governance: Theories, Discourses and Practice

Development and planning theories as well as ‘good governance’ discourses emphasize the need for community participation in urban governance, as a way to deepen and to broaden the culture and practice of democracy amongst citizens, as well as to render urban policies and their implementation more legitimate and/or more efficient. Community participation is therefore often understood as a panacea for urban governability and for democratisation - both by a body of theories and a set of political actors (from the local to the global levels). The course aims at critically engaging with this
academic as well as political literature, and question them in particular through the study
of the practices of community participation and the various types of challenges these
practices entail. It is also focused particularly at empowering students to communicate
their findings to different audiences, using different methodologies and in particular
graphic devices.

**ARPL7048A Democratic Theory**

This course examines some key issues and developments in democratic theory. The first
block looks at basic questions about democracy: its definition, history, rival traditions,
justification and key problems. The second block examines a range of democratic models,
techniques and arenas. The course examines both the historical theory and practice of
democracy and proposals for extending and deepening democracy in the future.

**ARPL7049A Politics, Governance and the City**

Who governs in contemporary cities? How are decisions regarding urban policies and
urban projects made and implemented? What is the role of business in setting the urban
strategic agenda? What is the power of residents’ associations and cívics to have their
voice heard in urban governance? The objective of this course is to provide theoretical
as well as practical responses to this type of questions. Theories of urban regimes, urban
governance, participation, social movements and political mobilization will be presented
and their relevance for African cities debated through different case studies.

**ARPL7050A The Making of Urban South Africa**

The course explores 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. Its 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. A central spine to
the unit is provided by a set of related questions: what impelled people to the towns?
How and why did they become fully urban? What new cultures and identities emerged in
the multi-racial and multi-ethnic urban melting pot? What new communities and political
urbanization emerged? How do we understand un-governability in the 1940s and 1980s?
What new laws and policies were formulated (e.g. segregation, apartheid and post
apartheid reform) to regulate and repress these processes and forces? How and why did all
of the latter happen? How central were the cities to understanding the more general
processes of historical change in South Africa and the sub-continent?

**ARPL7051A Violence, States, Movements**

Post-apartheid South Africa is seen as an extraordinarily violent society, with violent
clashes between protesters, strikers and the state, outbreaks of xenophobic violence, and
high levels of violent crime. This has happened at the same time as South Africans have
begun to experiment with representative forms of democracy (both at the level of the state
and within popular movements), and been celebrated as ‘the miracle nation’. This course
will explore 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.
ARPL7052A  Technologies and Techniques for the Built Environment (10 points)

The course provides an introduction to procedural and analytical techniques used in planning. This course 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.

ARPL7054A  Energy for Sustainable Cities

The course will be covered through five key topics as follows:
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

ARPL7055A  Energy Efficiency and Renewable Energy for Buildings

The course will be covered through five key topics as follows:
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

ARPL7057A  Urban Design Professional Practice (10 points)

The course introduces students 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. Students will be 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.

ARPL7058A  Global City Studio (10 points)

The design studio deals with global and cosmopolitan aspects of cities. International economic and trade linkages are explored through event cities (world cups, Olympics etc.), tourism, and world heritage sites. Other global forces expressed through catalytic projects, gating, and R D communities are emphasized.

ARPL7059A  Accessible City Studio (10 points)

Design studio dealing with 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.
ARPL7060A Sustainable City Studio (10 points)
This design studio deals with sustainable cities. The course will focus on the design of open space systems, landscape and natural settings, urban infrastructure. The course will also investigate how landscape and natural issues intersect with built form consideration through urban development infrastructure, sprawl vs. compact cities, and energy and resources.

ARPL7061A Transforming City Studio (10 points)
The design studio deals with transforming cities which include the following themes: post-colonial cities, habitable cities, fragmented and segregated cities, communities in transition, and informalisation.

ARPL7063A Governance and Municipal Planning
This unit deals with municipal planning within the context of ‘developmental local governance’. It deals with:
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.

ARPL7064A Research Report
This course involves supervised writing of a research report. It involves the definition of a research problem, question and hypothesis; a relevant literature review on the subject; empirical research involving quantitative or qualitative analysis; and the production of a research report drawing together all aspects of the work.

ARPL7066A Housing Finance and the Law
This seminar-based course enables the qualifying students to analyse existing and proposed legal 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. This course covers international and local perspectives on key aspects of housing finance. It examines the positions of international agencies, governments, banks, developers, civic organisations/civil society and end-users. It discusses sources of housing finance, various models for the structuring and release of government subsidies, private sector finance, end-user finance, credit and savings mechanisms. Through local and international case studies, housing finance approaches are explored that might overcome key inadequacies in South African low cost housing environments.

The course also provides an introduction to and a general understanding of some of the legal issues that impact on housing. The course will engage with the Bill of Rights and the principles behind the relevant legislation, the application of the legislation in a broad context and its application within the local housing market. Areas to be covered include the Gazetted legislation, local authorities controls, applicable building standards and regulations, health controls, consumer protection, tenure, environmental and planning laws and facilitation of developments.

ARPL7067A Management of Existing Housing Stock
The aim of this course is to provide an introduction to the basic tools and techniques for running and managing existing housing stock. The course will highlight the basic principles of property management and cover 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.

**ARPL7068A Housing Construction Technology and Management**

The aim of this course is to provide students with an understanding of, and insight into, the principles of housing construction technology and management. By the end of the course, students should be able to analyse and synthesise various technological and managerial issues of housing and make informed decisions from them. The course will help students to understand the processes involved in putting together a housing construction project, organising construction sites, managing material supply and production, ensuring structural and environmental standards and dealing with fire risks and prevention. It will also provide students with basic knowledge on the technology of housing modernisation and safety.

**SCHOOL OF CHEMISTRY**

**CHEM1012A Chemistry I (Major)**

(36) (3-2-1½) (2 terms)

Topics include: Stoichiometry, thermochemistry, electronic structure of atoms, periodic properties, chemical bonding, gases, intermolecular forces, liquids and solids, properties of solutions, chemical kinetics, chemical equilibrium, aqueous equilibria, chemical thermodynamics, organic chemistry, polymers, electrochemistry, metals, co-ordination compounds.

Laboratory work involves the mastering of basic laboratory skills and study of the behaviour of some organic and inorganic substances.

**CHEM1031A Chemistry I**

(33) (3-2-1) (2 terms)


**CHEM1033A Chemistry I (Auxiliary) (Full Time)**

(15) (4-1-3) (1 term)

This course is designed to expose students not intending to proceed to a second qualifying course in chemistry to the principles and practical considerations that underlie chemical phenomena in engineering, industrial and mining processes. Topics covered include metals and alloys, the thermodynamics corrosion and other redox reactions, the chemistry of the atmosphere/environment, alternative energy sources, acids and bases, aqueous solutions and materials. Six laboratory experiments accompany the lectures and illustrate practical aspects of the topic material.
CHEM1049A  Chemistry I (Auxiliary) (Part Time)

(15) (4-1-3) (1 term)

This course is designed to expose students not intending to proceed to a second qualifying course in chemistry to the principles and practical considerations that underlie chemical phenomena in engineering, industrial and mining processes. Topics covered include metals and alloys, the thermodynamics and kinetics of corrosion and other redox reactions, the chemistry of the atmosphere/environment, alternative energy sources, explosives, acids and bases, aqueous solutions and materials. Six laboratory experiments accompany the lectures and illustrate practical aspects of the topic material.

CHEM2017A  Chemistry II

(24) (3-1-0) (2 terms)

Gases; Intermolecular forces, liquids and solids; Properties of solutions; Additional aspects of aqueous equilibria; Chemical thermodynamics; Electrochemistry; Metals and Metallurgy;

Industrial organic chemistry: an overview of the organic chemicals industry.

Industrial inorganic chemistry: an overview of the inorganic chemicals industry.

Prerequisite: CHEM1031A

CHEM2018A  Chemistry II (Metallurgy)

(12) (3-1-0) (1 term)

Gases; Intermolecular forces, liquids and solids; Properties of solutions; Additional aspects of aqueous equilibria; Chemical thermodynamics; Electrochemistry; Metals and Metallurgy.

Prerequisite: CHEM1031A

SCHOOL OF CHEMICAL AND METALLURGICAL ENGINEERING

CHMT1002A  Introduction to Process and Materials Engineering

(30) (3-4-0) (2 terms)

This course provides an introduction to process engineering calculations and problem solving, and also exposes students to the principles of engineering drawing.

Elementary calculations in process analysis and design: This course provides the foundations of elementary engineering principles and engineering problem solving, which are built upon in later years. Specifically, students are introduced to engineering units and key variables in process engineering, units of measurement and unit conversions, non-reactive and reactive mass balances, material balance calculations, stoichiometry.

Discussion of some common industrial processes in Chemical and Metallurgical Engineering.

Drawing: drawing standards, freehand sketching, projections, fundamental spatial relations and intersections, sectioning, dimensions and tolerances.

CHMT1001A  Physics for Chemical Engineering

(27) (4-1-0) (2 terms)

First semester: General: length, mass, time, units, conversion of units, elasticity, Hooke’s law. Mathematical background: series expansions, small angle approximations, introductory calculus, vectors, scalars, vector algebra, scalar and vector products. Statics: Newton’s law of motion, forces at a point, co-planar forces, torque, centers of mass and
gravity, stability, equilibria, frameworks. Kinematics: velocity, speed, acceleration, free falling objects, projectile motion, circular motion and acceleration, relative velocity and acceleration. Dynamics: inertial frames, mass and weight, free body diagrams, friction, motion in accelerated frames, work, power, kinetic and potential energy, Hooke’s law, conservative and non-conservative forces, conservation of energy, total mechanical energy.


**CHMT2009A Introductory Mineralogy and Earth Sciences**

(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, utilization and properties of coal is offered.

**CHMT2011A Computing for Process Engineers**

(15) (3-2-0) (1 term)

A chosen high level language will be used to perform calculations in areas relevant to process engineering. The emphasis is on doing the calculations, not on producing professional programming code for others to use. The core objective of the course is to equip students with basic computer programming skills and the ability and knowhow to implement these skills in solving engineering problems, in chemical and metallurgical plants.

**CHMT2013A Process Engineering Fundamentals**

(33) (2-2-0) (1 term) (3-3-0) (1 term)

The course will include material that is fundamental to Chemical and Metallurgical Engineering, and that is deemed necessary as a foundation for advanced courses taught in the 3rd and 4th years of study. For example: particulate systems, introduction to kinetics and reactors, pumps and momentum balances, heat transfer, numerical techniques and hydrometallurgy.

**Prerequisite:** CHMT1002

**CHMT2014A Energy Balances and Applications**

(18) (2-1-2) (1 term) (1-1-0) (1 term)

Energy balances and applications of energy balances specific to Chemical Engineering. For example: energy balances, applications of energy balances, enthalpy departures and non-ideal gases, vapour liquid equilibrium, psychrometry and energy balance design. The course will include laboratory sessions in the first semester and projects, typically a mass and energy balance for a process flowsheet.

**Prerequisite:** CHMT1002A

**Corequisite:** CHMT2013A
CHMT2017A Introduction to Extractive Metallurgy

This course explores methods of extracting metals from ores and how these processes fit into the mineral resource sector. The unit includes: mineral processing/ore dressing (crushing, grinding, sizing, concentration, solid-liquid separation,), pyrometallurgy (fuels, roasting and calcining, agglomeration, smelting oxides and sulfides), hydrometallurgy (chemical principles, processing steps and practical considerations), Integrated circuits, metal accounting, mass and energy balances; Introduction to process flow sheets in Extractive Metallurgy

Corequisite: CHMT2018A

CHMT2018A Practical Metallurgy

(12) (1-0-1) (2 terms)

Practical introduction to metallurgical engineering. Laboratory experimental sessions in physical metallurgy, hydrometallurgy and minerals processing as per set guidelines. Analyse, interpret and present the results of the lab exercise from both a technical and scientific basis. Prepare a technical report based on the work carried out.

Prerequisite: CMHT1002A and PHYS1025

Corequisite: CHMT2019A, CHMT2017A

CHMT2019A Materials Science and Engineering

(15) (4-1-0) (1 term)

A general introduction to engineering materials. The changing needs of industry are discussed and the necessity of selection criteria additional to properties are outlined. The relationships between processing, structure, properties and application is emphasised. The main engineering materials: metals, ceramics, polymers and composites are discussed in terms of structure, properties and application. Structure is described on atomic, crystalline and microstructural levels. Phase diagrams are introduced. The degradation of materials is described. Mechanical properties of materials: tensile testing; creep; wear, simple fracture mechanics; and fatigue.

Prerequisite: PHYS1025A

Corequisite: CHMT2018A

CHMT1997A Practical Training (Metallurgy and Materials Engineering)

Practical training will take place over a period of one week and is designed to provide familiarity with the following aspects of engineering through hands-on experience:

1) workshop fabrication
2) equipment operation and maintenance
3) electrical engineering

CHMT1998A Vacation Work I (Metallurgy and Materials Engineering)

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 a metallurgical laboratory or plant and should be according to the departmental guidelines for vacation work.
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/or a report on the work undertaken during the period of vacation employment.

**CHMT3000A  Transport Phenomena**

(27) (2-2-0) (2 terms)

Derivation of the fundamental equations of momentum, energy and mass transfer. Application to the modelling of engineering systems by making simplifying assumptions. Solution of resulting differential equations using analytical and numerical techniques. Topics to be studied include laminar and turbulent flow in various geometries, heat and mass transfer in solids and fluids, heat transfer with phase change (e.g. condensation, solidification), radiation heat transfer and furnace design.

*Prerequisite:* CHMT2013A and MATH2011A

**CHMT3003A  Chemical Engineering Thermodynamics**

(27) (2-2-0) (2 terms)

External and internal energy, mechanical and thermal transfer of energy, conservation of energy; entropy, the ‘second law’, Legendre transforms, enthalpy, Gibbs and Helmholtz functions; generation of entropy. Flow processes, engines, ‘heat’ pumps, compressors and turbines, refrigeration and power cycles, thermodynamic efficiency; exergy, thermodynamic analysis of the chemical plant. Fugacity, activity coefficients; equilibrium between phases, miscibility (total and partial). The equilibrium constant of chemical reactions in all phases at low and high pressures. Energy balance for chemical reactors and autothermal behaviour.

*Prerequisite:* CHMT2014A

**CHMT3004A  Chemical Engineering Laboratory**

(18) (1-0-5) (2 terms)

Experimental work is performed in the laboratory illustrating basic chemical engineering principles. Practice is obtained in applying theory to real systems, drawing conclusions from experimental results and preparing reports.

*Prerequisite:* CHMT2013A and CHMT2014A

**CHMT3005A  Mass Transfer Operations**

(12) (2-2-0) (1 term)

Binary diffusion. Definition of mass transfer coefficient. Estimation of mass transfer in continuous contact operations. Equilibrium stage processes. Distillation (binary and multicomponent), liquid-liquid extraction, absorption, membrane separation, crystallisation. Other mass transfer operations.

*Prerequisite:* CHMT 2013A, CHMT 2014A and MATH2011

**CHMT3006A  Process Design Principles**

(22) (2-2-0) The course syllabus includes the following topics: an overview of process design, the design report and its requirements, equipment selection and design, design costing and profitability, safety in process design, process synthesis and simulation, pinch technology, and process optimization.

*Prerequisite:* CHMT2013, CHMT2014 and MATH2011
**CHMT3008A  Numerical Methods (Chemical)**

(12) (2-2-0) (1 term)


*Prerequisite:* MATH2011A

**CHMT3009A  Metallurgical Thermodynamics**

(24) (3-1-0) (2 terms)


*Pre-requisite:* CHEM2018

**CHMT3014A  Engineering Failure Analysis**

(9) (2-1-0) (1 term)

This course is about engineering problem-solving through application of fundamental and specialist knowledge leading to engineering design, synthesis and manufacture as well as to experimentation, investigation, data analysis and engineering methods:

Failure analysis: Importance of analysing failure, causes of failure, typical failure analysis case studies, non-destructive inspection.

Fatigue failure: Designing against fatigue, fatigue mechanisms in metals and nonmetallic materials, fractographic features of fatigue, introduction to the problems of welded structures, importance of design detailing.


*Prerequisite:* CHMT2019A

**CHMT3016A  Applied Mathematics Topics**

(18) (3-1-0) (2 terms)

This course consists of the following modules:

Numerical Methods

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).

Statistics

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.

Prerequisite: MATH2012A

CHMT3017A Biomedical Transport Phenomena

(6) (2-0-0) (1 term)

Introduction to mass transfer and its application to biological systems. Analysis of lung and kidney function as well as other mass transfer organs. Aspects of pharmacokinetics. Artificial organ design. Biological fluid flow and cardiovascular dynamics.

CHMT3018A Ore Dressing and Extractive Metallurgy
(Mining)

(12) (3-1-0) (1 term)

This course is usually offered in second term, whereby students are exposed to specialist engineering topics.

Ore dressing: basic principles of crushing and grinding, screening, classification, gravity concentration, magnetic and electrostatic separation, flotation, sedimentation, thickening and filtration.

Coal preparation: coal processing principles and technology of coal usage after mining.

Hydrometallurgy: basic principles of main unit operations such as leaching, heap leaching, solvent extraction, ion exchange and electrowinning/refining; industrial metal extraction processes such as gold, copper, uranium, zinc.

Pyrometallurgy: roasting and calcination of concentrates; smelting converting, industrial metal extraction processes such as copper, lead, zinc as well as iron and steelmaking.

CHMT3019A Kinetic and Transport Processes in Metallurgical Engineering

(15) (4-1-0) (1 term)


Prerequisite: CHMT2017

CHMT3021A Solidification, Heat Treatment and Microstructure

(15) (4-1-0) (1 term)

Development of microstructure in Fe-C alloys with emphasis on bainite and martensite formation; annealing; normalizing; tempering, hardenability; aging; design of heat treatments; surface heat treatments; principles of solidification.

Prerequisite: CHMT2019A
CHMT3024A  Environmental Process Engineering
(9) (2-1-0) (1 term)
By the end of the course, the student will have obtained 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. The course will include environmental legislation, current codes of practises, and health, safety and risk aspects, pertinent to South African and global operations. The students will understand and apply basic strategies for the prevention and treatment of waste, water, waste-water, and air pollution, and the links between the different systems. Engineering professionalism and ethics will be addressed via the understanding of the impact of engineering activity on the environment.

Prerequisite: CHMT1002

CHMT3025A  Crystal Structure and Analysis
(12) (3-1-0) (1 term)
Crystal structures: Application of crystallography, point groups and space groups to understand the structures of different phases and the reciprocal lattice. Use of stereographic projections to analyse deformation in cubic materials. Relation of defects in crystals, and texture to the properties of metals.
Analytical techniques: Evaluation and application of optical microscopy, X-ray diffraction, scanning and transmission electron microscopy, including EDX, to analyse and characterise microstructure. Description of techniques to analyse textures. Introduction to Mossbauer spectroscopy. Application and understanding of these techniques to materials characterisation, together with specialist techniques.

Prerequisite: CHMT2019A

CHMT3026A  Process and Materials Design
(21) (2-1-0) (2 terms)
The course includes the following topics: An overview of process design, examples of reactor models i.e. continuous stirred tank reactor (CSTR) and plug flow reactor (PFR), process design deliverables, constraints in design, metallurgical equipment flow-sheeting symbols, basics of flowsheet development, basics of project management, how to write a design report, equipment selection, sizing and costing and economic evaluation of a metallurgical facility, calculation of DCF, NPV, IRR, health, safety and environmental considerations. Lectures are also tailored for specific metallurgical process unit operations topics that cover the range of extractive metallurgy i.e. mineral processing (milling, flotation, thickening e.t.c), pyrometallurgy (smelting, roasting e.t.c) and hydrometallurgy (leaching, counter current decantation, carbon in pulp or leach, electrowinning e.t.c).
Process design mini projects based on the specific topics are formulated and completed by students working in both groups and individually. Verbal presentations by students are done for selected design mini projects. Application of simulation packages like modsim, pyrosim and matlab are mandatory.

Prerequisite: All 1st and 2nd year subjects
CHMT3027A  Corrosion and Wear  
(15) (3-1-1) (1 term)
Understanding and use of general corrosion theory, including electrochemistry, thermodynamics and kinetics. Identification of different corrosion forms and passivity, and a knowledge of the fundamental mechanisms involved in each case, as well as application of corrosion principles in the understanding of the corrosion situations. Experience in various corrosion testing methods. Design against corrosion by using cathodic and anodic protection, material selection, application design, environmental control and surface treatments. Understanding the tribological principles of friction, wear and lubrication. Mechanisms of wear. Methods to limit wear. Application of various aspects of surface engineering such as surface modifications and surface coatings.

Prerequisite: CHMT2019A

CHMT3028A  Non-Ferrous Pyrometallurgy  
(12) (2-1-1) (1 term)
This course applies the fundamental knowledge of physical chemistry to various high temperature processes encountered in the production of metals and alloys. The unit processes are reduction smelting, sulphide smelting, converting refining and fused salt electrolysis. The production of copper, zinc, aluminium, tin, lead, magnesium and various alloying metals as ferroalloys are given with reference to their unit operations. Specialist knowledge with respect to source of metals; pretreatment processes such as roasting, calcination, sintering, pelleting are covered. Impact of pyrometallurgy on society and environment is also emphasised. When all the above is synthesized by the students they will be able to apply the information to engineering problem solving, data analysis and simple process design. A laboratory session in non-ferrous pyrometallurgy will be included.

Prerequisites: CHEM2018A and CHMT2017A
Corequisite: CHMT3009A

CHMT3036A  Chemical Reaction Engineering  
(20) (2-2-0) (2 terms)
The module covers: The design of ideal reactors (batch, semi-batch, continuous stirred tank reactors, plug flow reactors) for homogeneous reactions at isothermal and non-isothermal conditions, with and without pressure drop (packed bed reactors). Ideal reactor design for multiple reactions. Heterogeneous chemical reactions engineering. Introduction to catalysis engineering (catalysis & catalytic reactors): synthesis, characterisation and application catalysis theory, collection and analysis of experimental rate data and use of such data in the design of catalytic reactors. Non-ideal reactors and residence time distribution as a diagnostic tool

Prerequisite: CHMT2013A, CHMT2014A and MATH2011A

CHMT3037A  Process Design Principles  
(22) (2-2-0) (2 terms)
The course syllabus includes the following topics: an overview of process design, the design report and its requirements, equipment selection and design, design costing and profitability, safety in process design, process synthesis and simulation, pinch technology, and process optimization.

Prerequisites: CHMT2013A, CHMT2014A and MATH2011A
CHMT1996A Vacation Work (Chemical)
Vacation work should be completed during a period of six consecutive weeks in the year after which credit is obtained for third year. Where possible the vacation work should take place in a chemical works and should be according to the departmental guidelines for vacation work. 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/or a report on the work undertaken during the period of vacation employment.

CHMT1999A Vacation Work II (Metallurgy and Materials Engineering)
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 a metallurgical plant and should be according to the departmental guidelines for vacation work. 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/or a report on the work undertaken during the period of vacation employment.

CHMT4000A Hydrometallurgy
(9) (2-1-0) (1 term)
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
Carrier phase separation (solvent extraction and carbon adsorption processes)
Electrorecovery processes (electrorefining and electrowinning)
Prerequisite: CHMT3024A

CHMT4002A Physical Chemistry of Iron and Steel Manufacturing
(12) (3-1-0) (1 term)
This course aims to present the physico-chemical aspects of ferrous production metallurgy in sufficient detail for the student to apply the fundamental and specialist knowledge in terms of the interrelations between the thermodynamics and kinetic, or chemical influences and the physical (heat, mass and momentum transfer) effects which influence the industrial processes to be able to solve engineering problems. Lectures cover: conventional blast furnace ironmaking; modelling of blast furnace; alternative ironmaking methods: direct reduction; oxygen steelmaking: top, bottom-blown and mixed processes; electric steelmaking; secondary steelmaking and refining and stainless steel: AOD process. The impact on society and the environment is also emphasised.
Prerequisite: CHMT3009A
CHMT4003A  Metallurgical Design
(30) (1-0-8) (2 terms)
Students are required to complete a full Metallurgical Plant Design. Students work in groups of 4 -5, each group is required to develop a process flowsheet based on the specification of the feed material provided and to compare it with alternatives. Each student is given an individual annual plant throughput and an individual unit in the flowsheet to design in detail. Mass and energy balance is done on the whole plant. The major equipment units are approximately sized for costing purposes. A complete economic analysis of the process is required. It is required that the social, legal, health, safety and environmental impacts of the design be assessed. A detailed report is to be compiled using an accepted structure, style and graphical support. 
Prerequisite: All third-year courses

CHMT4004A  Research Project
(30) (1-0-8) (2 terms)
The course covers several components related to a research project, i.e. the compilation of a research plan/proposal, how to conduct and write a literature review, introductory safety measures, risk analysis and health and safety precautions, good laboratory practice, the writing of research reports and draft journal papers, oral communication skills, poster presentation skills, execution of planned laboratory work and data gathering and analysis. 
Prerequisite: All third-year courses

CHMT4005A  Management for Process Engineers
(12) (3-1-0) (1 term)
Financial management: Origins of financial information, introduction to and analysis of financial statements, final decision making and risk management.
Operations management from a process engineering perspective: TQM and time-based competition.
Management Control of Projects: Critical Path Analysis, Object of project management.
Engineering Ethics: Engineering Ethical Codes, Ethics case studies.
Prerequisite: CHMT3024A

CHMT4006A  Solid Fluid Systems
(9) (2-1-0) (1 term)
Particle characterisation (quantitative particle size distributions; effects of particle shape, composition and surface properties). Behaviour of particles in fluids (settling velocities, drag forces etc as functions of particle and fluid properties). Slurry rheology – its significance, modelling and prediction. Pressure drop in packed beds. Application of these principles to the modelling, analysis, design, and optimisation of industrial processes.

CHMT4008A  Particulate Systems
(12) (3-1-1) (1 term)
Characterisation of particulate populations: quantitative description of particle size, nominal diameters, types of distributions for particle populations as a function of their physical properties (size, grade, relative density, extent of liberation). Influence of various forces (fluid drag, gravity, magnetic, electrostatic) on motion and fracture of particles, particle/particle effects. 
Steady-state simulation of mineral processing plants (2 projects will be completed)
**CHMT4009A  Chemical Engineering Design**

(30) (1-0-8) (2 terms)

Students are required to complete a full Chemical Plant Design. Each student is required to develop a process flowsheet and to compare it with alternatives. Some of the major equipment is required to be designed in detail while other items are approximately sized for costing purposes. It is required that the social, legal, health, safety and environmental impacts of the design be assessed. A complete economic analysis of the process is required. A detailed report is to be compiled using an accepted structure, style and graphical support.

*Prerequisite:* All third-year courses

**CHMT4011A  Process Control**

(12) (2-1-1) (1 term)


*Pre-requisites:* (CHMT3008A and CHMT3000A) or (CHMT3019A and CHMT3016A)

**CHMT4012A  Advanced Chemical Engineering B**

(9) (2-1-0) (1 term)

A chosen topic in Chemical Engineering will be studied in depth. A problem will be identified and formulated, the critical factors will be identified, the system will be analysed and modelled and alternatives will be evaluated. The impact of design decisions will be assessed and the implications of these decisions evaluated.

**CHMT4013A  Advanced Chemical Engineering C**

(9) (2-1-0) (1 term)

A chosen topic in Chemical Engineering will be studied in depth. A problem will be identified and formulated, the critical factors will be identified, the system will be analysed and modelled and alternatives will be evaluated. The impact of design decisions will be assessed and the implications of these decisions evaluated.

**CHMT4014A  Advanced Chemical Engineering D**

(9) (2-1-0) (1 term)

A chosen topic in Chemical Engineering will be studied in depth. A problem will be identified and formulated, the critical factors will be identified, the system will be analysed and modelled and alternatives will be evaluated. The impact of design decisions will be assessed and the implications of these decisions evaluated.

**CHMT4015A  Welding and Forming Processes**

(9) (2-1-0) (1 term)

Prerequisites: CHMT3021A

CHMT4017A Structure and Properties of Engineering Materials

(12) (3-1-0) (1 term)
The course has two major components which are covered in turn. The theme throughout the course is how structure determines the properties, and hence applications.
Structure and properties of non-metallic materials: For each type of material, the origin of the structure will be discussed and then related to the physical and mechanical properties.
Ternary Phase Equilibria: Students are introduced to both the principles and the major representations of ternary diagrams.
Solid state transformations: The fundamentals of solid state phase transformations are covered, including solid state nucleation, growth, and the contribution of diffusion.
Powder Metallurgy: Students are introduced to Powder characterization, fabrication, compaction, sintering, heat treatment of Powder metallurgy parts and design considerations in Powder metallurgy.
Prerequisites: CHMT3021A, CHMT3025A

CHMT4019A Chemical Engineering Research Project

(30) (1-0-8) (2 terms)
The course covers several components related to a research project, i.e. the compilation of a research plan/proposal, how to conduct and write a literature review, introductory safety measures, risk analysis and health and safety precautions, good laboratory practice, the writing of research reports and draft journal papers, oral communication skills, poster presentation skills, execution of planned laboratory work and data gathering and analysis.
Prerequisite: All third-year courses

CHMT4020A Hydrometallurgical Processes

(12) (2-1-1) (1 term)
- 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
- Carrier phase separation (solvent extraction and carbon adsorption processes)
- Electrorecovery processes (electrorefining and electrowinning)
- Laboratory session in Hydrometallurgy
Prerequisite: CHMT3024A and CHMT3026A

CHMT4029A Biochemical Engineering

(9) (2-1-0) (1 term)
The semester course provides an introduction to Biochemical engineering and may cover the following topics:
Introduction to microbiology, DNA and cell physiology;
Enzyme kinetics;
Metabolic pathways, thermodynamics of metabolism, aerobic and anaerobic metabolism;
Stoichiometry of cell growth;
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;
Genetic manipulation of organisms; and
Industrial use of bio-processes

**Postgraduate Courses**

*(Subject to availability)*

*(All courses 20 credit points unless otherwise indicated)*

**CHMT5000A  Introduction to Extractive Metallurgy**

Introduction to principles of physical, hydrochemical, electrochemical and thermochemical processing. Unit operations. Introduction to ore mineralogy. Size reduction and classification, particle separation, stoichiometric and mass balance calculations, chemical equilibria, aqueous processing, smelting and refining.

**CHMT5001A  Metallurgical Process Modelling & Design**

Fundamentals of specific metallurgical unit processes will be given. Topics of general nature such as brainstorming, costing, and specification, professional ethics, material selection, occupational health and safety legislation and elementary principles of engineering drawing and flowsheet construction will be covered. Mini-design project(s) will be given to the class and students monitored and guided. On completion of the project verbal presentation will form part of the assessment.

**CHMT5002A  Extractive Metallurgy Investigative Project**

There is no specific course content as student will be allocated a project that may emanate from industry or as proposed by the supervising academic.

**CHMT5003A  Principles of Hydrometallurgy**

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 Electrorecovery processes (electrorefining and electrowinning).

**CHMT5004A  Principles of Mineral Processing**


**CHMT5005A  Principles of Pyrometallurgy**

This course applies the fundamental knowledge of physical chemistry applicable to various high temperature processes encountered in the production of metals and alloys. The unit processes include principles of pyrometallurgy, solid state pyrometallurgy, liquid state pyrometallurgy, gaseous state pyrometallurgy. The production of iron and steel, ferroalloys and base metals. Impact of pyrometallurgy on society and environment is also emphasised.
**CHMT5006A Introduction to Petroleum and Offshore**

Modules to be presented include:

A - Role of the petroleum engineer and other associated professionals in petroleum exploration and production industries.
B - The nature of oil and gas; the formation of oil and gas; source rock, reservoir rock.
C - Petroleum traps; overview of petroleum exploration and production process.
D - An introduction to drilling and production engineering.
E - Basic rock and fluid properties, and Darcy’s Law.
F - Introduction to petroleum drilling and production,
G - Offshore drilling rigs, Ocean Environment,
H - Loads on offshore structures, Fixed and floating offshore platform design,
I - Mooring systems and dynamic positioning systems, Marine risers, Offshore pipelines, Top-side facilities,
J - Offshore installations, Materials for offshore applications

**CHMT5007A Petroleum Reservoir and Production Engineering**

Modules to be presented include:

A - An introduction to petroleum production systems including reservoir’s inflow performance and well’s outflow performance concepts, formation damage mechanisms, and nodal analysis.
B - Basic well completions including options, types, properties, and selection based on producing scenarios, and familiarization of different downhole completion equipment
C - An overview of artificial lift systems including technologies, equipment and fundamental mechanisms of each system, and artificial lift selection criteria.
D - Analysis and optimization of total petroleum production systems using conventional and nodal analysis.
E - Basic concepts of reservoir engineering,
F - Rock properties, PVT analysis and material balances,
G - Hydrocarbon in place and recovery, fluid flow in porous media,
H - Darcy’s law and applications, radial flow and transient test analysis

**CHMT5008A Drilling and Completion Engineering with Laboratory**

Topics to be presented include:

A: Introduction to drilling fluids, drilling fluid properties, drilling equipment and procedure
B: Clay mineralogy and colloid of drilling
C: Rheology and hydraulics of drilling fluids
D: Filtration properties of drilling fluid
E: Make-up materials and additives for drilling/completion fluids
F: Drilling/completion fluid systems
G: Borehole stability and loss circulation
H: Solid control during drilling
I: New developing technology of drilling/completion
J-Overview of the fundamental aspects of drilling engineering
K-Introduction to drilling fluid and cementing
L-Introduction to fluid hydraulics
M-Introduction to drilling simulator
N-Rheological properties of drilling fluids.
O-Drillstring design and cementing operations.

**CHMT5009A Risk Management and Sustainable Development in Oil & Gas Engineering**

Modules to be presented include:
A - Risk management. Accident sources, consequences and preventative action.
D - Linking HAZOP with process control, instrumentation and alarm systems.
F - Sustainable development is about forms of progress that combine economic development, social advancement, environmental protection and is widely recognised by the public, private and civic sectors as one of the key challenges for the 21st century.
G - Deals with the contribution of engineering to the development and implementation of sustainable solutions.
H - Introduction to the sustainable development agenda.
I - Practical methods and tools for development and implementation of sustainable solutions which complement generic 'good engineering and management practice'.

**CHMT5010A Natural Gas Production and Oilfield Processing**

Modules to be presented include:
A - Introduction, Properties of natural gases;
B- Natural gas processing and treatment; Liquid recovery, dehydration and sweetening;
C- Removal of water and acid gases; Hydrogen sulphide conversion; Temperature distribution in pipes; Natural gas hydrates and hydrate prevention methods; Oil and gas separators; Oil absorption and stripping;
D- Condensate removal; Natural gas liquefaction; Process design; Heat exchangers, heaters, cooling methods; Pumps and compressors; Measuring devices, health and safety equipment
E - Introduction to Oilfield Processing; Measurement and Instrumentation;
F - Relief systems and Storage; Multiphase flow calculations in pipe lines; Separator design and sizing of flow lines;
G - Pumps and Hydraulic Turbines; Hydrate formation and remedial options; Hydrocarbon Recovery;
H - Utilities in upstream processing; Dehydration and hydrocarbon treating; Compressors,
I - Expanders and Refrigerators

**CHMT5011A  Oil and Gas Engineering Project**

Modules to be presented include two sections:

**Design**

A - Process design, Process engineering, Project management for oil and gas production environment.

B - Process evaluation and selection. Site location, plant layout and process flowsheet and piping diagram.

C - Preliminary design, specifications and equipment schedule. Environmental impact. Industrial codes and legislation.


E - Full specification and complete chemical engineering design. Materials of construction, mechanical design, structural support,

F - Environmental, HAZOP, operability, costing, energy considerations, start-up and shutdown,

G - Maintenance, process control and instrumentation and detailed drawing.

H - Pressure vessel design using AS1210. Pump and piping specifications.

**Research Laboratory**

I - Assigned project involving investigation of some aspects of a chemical, petroleum and petrochemical engineering processes or plant using appropriate research methods.

J - The research topic should be Oil and Gas bias

**CHMT5012A  Vacation/Industrial Training (Oil & Gas Engineering)**

Modules to be presented include:

A - Assigned project involving investigation of some aspects of a chemical, petroleum and petrochemical engineering processes or plant using appropriate research methods.

B - This is experiential training undergone in the Oil and Gas industry environment

**CHMT5013A  Design and Construction of Welded Structures under Static Loading**


**CHMT5014A  Design and Construction of Welded Structures under Dynamic Loading**

CHMT5015A  Practical Education Welding and Fabrication Processes

Practical exposure to structural welding practice guided by experts intended to introduce candidates to realities of structural welding so that theory can be understood in context. Introduction to the engineering of welding. Exposure to University library guided by library staff intended to assist structured report writing.

CHMT5016A  Fabrication Applications Engineering


CHMT5017A  Non-Destructive Testing Methods and Economics


CHMT5018A  Case Studies for Welding Engineers

This course covers:

Steel & lightweight structures, boilers and pressure vessels. Chemical plants and pipelines. Shipbuilding and offshore applications. Transportation (automobiles, railways), aerospace applications.

CHMT5019A  Welding Metallurgy of Steels


CHMT5020A  Weldability of Alloy Steels and Stainless Steels

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; Stainless and heat resistant steels.

CHMT5021A  Weldability of Ferrous and Non-Ferrous Materials

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; destructive testing.

CHMT5022A  Welding Processes and Equipment

CHMT5023A Other Welding Processes
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

CHMT5024A Advanced Welding Processes
Brazing and soldering, joining processes for plastics. Joining processes for ceramics and composites. Guidance by skilled welding teachers. Practical training on oxy acetylene welding and cutting, MMA, TIG, and MIG/MAG. Familiarisation with the difficulties and typical defects associated with incorrect use of the different welding methods. Welding laboratory including bend tests

CHMT7000A Laboratory/Research Project
There is no syllabus for this course – the topic varies from year to year.

CHMT7005A Coal Sampling and Quality Assessment
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. Principles of integrated assessment, substitution, specification & classification.

CHMT7006A Coal Management and Marketing
Chain of impact between exploration, exploitation, beneficiation, production, marketing and utilisation; primary, secondary and tertiary product manufacture and use; energy and environmental impacts. 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; contractual legalities.

CHMT7011A Physiochemical Principles of Refractory Use

CHMT7012A Principles of Modelling and Control of Pyrometallurgical Processes

CHMT7013A Solid, Liquid and Gaseous State Pyrometallurgical Processes
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. Metal extraction routes.

**CHMT7014A  Kinetics and Transport Phenomena in Pyrometallurgy**


**CHMT7015A  Thermodynamics and Phase Equilibria in Pyrometallurgy**


**CHMT7016A  Selected/Special Topics in Pyrometallurgy**


**CHMT7018A  Materials Characterisation**

Materials selected from the following categories: Metals, Insulators and Semiconductors, Polymers and Polymer Composites, Ceramics, Nanomaterials and ones with interesting surface properties, such as Catalysts. Information needed to characterize each material will be identified and the type of physical interactions needed to obtain this information discussed. The details of the relevant technique will then be given, such as Electron Microscopy, Atomic Force Microscopy, X-ray Diffraction, Transmission –Electron Microscopy, Raman Scattering, Nuclear Magnetic Resonance, Mass Spectroscopy, Rutherford Backscattering.

**CHMT7019A  Advanced Materials Processing**

CHMT7020A Principles of Ceramic Processing

CHMT7022A Failure Analysis of Engineering Materials

CHMT7023A Transport Phenomena in Materials Processing

CHMT7024A Structure and Properties of Engineering Materials
Review of crystal structure and banding. Dislocation theory; plastic deformation, workhardening; 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, composition on properties of materials. Importance of matrix and fibre/particle properties on composites.

CHMT7025A Electrical, Magnetic, Optical and Thermal Properties of Materials
Introduction to 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. Applications of these properties will be presented.

CHMT7027A Thermodynamics & Phase Equilibria of Materials
**CHMT7028A  Physical Processing of Ores**
Particle characterization, comminution theory, mathematical modelling of crushers and mills. Classification process, solid-liquid separation. Simulation and optimization of circuits involving size reduction and classification.

**CHMT7029A  Mineral Beneficiation**

**CHMT7030A  Leaching Operations in Hydrometallurgy**

**CHMT7031A  Electrometallurgy**

**CHMT7032A  Separation Processes in Hydrometallurgy**

**CHMT7033A  Investigational Project - Mineral Processing (40 points)**
The course consists of a project in which a problem or topic is investigated and recommendations regarding a solution are made. A comprehensive report is required.

**CHMT7034A  Design Project - Minerals Processing (40 points)**
There is no syllabus for this course. The design problem will be distributed to each student by the course co-ordinator.

**CHMT7035A  Process Flowsheet Synthesis**
In designing a new process, most of the opportunities for significant innovation occur in the early stages. Yet the decisions which are made in this phase of the project are frequently made on the basis of doing the same as what is done on existing plants of the same type. The aim of this unit is to explore the opportunities and alternatives available to the process designer 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.

**CHMT7036A  Reactor Synthesis**
The unit will benefit chemists and chemical engineers who design reactors, experimental reaction programs, catalysts, etc. and who would like to learn a better method for synthesising a new reactor system or improving an existing one. The unit is to be open to both chemists and chemical engineers as the interaction between the two disciplines and the work they traditionally do will be emphasised.
CHMT7037A  Distillation Synthesis
In this unit we will review the development of a new approach to distillation. The unit includes sessions during which distillation synthesis will be applied to practical problems. An intuitive understanding of how thermodynamics affects distillation column design and distillation column sequencing will be achieved. The unit focuses on the implications of Distillation Synthesis for industrially applicable problems.

CHMT7038A  Applied Thermodynamics
Many graduate scientists and engineers only experience thermodynamics at a very high a and conceptual level of understanding. In the use of modern simulation software it is critical to have a very definite understanding of the role played by the system on a thermodynamic level. Thus there is a demand for a better understanding of the subject on a more practical and in depth level.

CHMT7039A  Applied Optimisation Methods
The following topics will be covered:
• Function minimization
  - 1D, 2D, 3D and nD
  - Newton-Raphson
• Constrained problems
  - Formulation of problems using penalty functions and how to solve these using Excel
• Linear Programming
  - Non-integer, integer and sensitivity analysis
• Model fitting and Parameter estimation
  - What do I need to fit?
  - How do I do the fitting?
  - What does it mean?
  - Have I got a good answer?
• Trajectory Optimization
  - Calculus of Variations
  - Dynamic Programming
  - Pontryagin
  - Attainable Regions
• Neural Networks
• Genetic Algorithms
• Pattern Search

CHMT7040A  Experimental Process Synthesis
In the process industry chemists and chemical engineers work side by side to design processes. Chemists and Engineers frequently have difficulty communicating with one another, due to their different backgrounds and ways of thinking. The aim of this unit is to bridge the gap between Chemists and Chemical Engineers, by examining thermodynamic fundamentals, analysis and modelling of experimental data, and the interaction of these aspects with process flowsheet design.
CHMT7041A Investigational Project - Process Engineering (40 points)

The course consists of a project in which a problem or topic is investigated and recommendations regarding a solution are made. A comprehensive report is required.

CHMT7042A Design Project - Process Engineering (40 points)

There is no syllabus for this course. The design problem will be distributed to each student by the course co-ordinator.

CHMT7043A Welding Processes and Equipment


CHMT7044A Other Welding Processes


CHMT7045A Advanced Welding Processes


CHMT7046A Fabrication, Applications Engineering

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, Reinforcing steel welded joints

CHMT7047A Non-Destructive Testing Methods and Economics

Non destructive testing of welded structures. Economics and productivity. Health and safety. Measurement, control and recording in welding

CHMT7049A Welding Metallurgy of Steels


CHMT7050A Weldability of Alloy Steels and Stainless Steels

High strength steels. Application of structural and high strength steels. Low alloy creep resistant steels. Low alloy steels for very low temperature applications. Introduction to corrosion. Stainless and heat resistant steels.
CHMT7051A Weldability of Ferrous and Non-Ferrous Materials


CHMT7052A Case Studies for Welding Engineers

Steel & lightweight structures, boilers and pressure vessels. Chemical plants and pipelines. Shipbuilding and offshore applications. Transportation (automobiles, railways), aerospace applications.

CHMT7053A Practical Education welding and fabrication processes

Site visits – particularly for those with no site experience. Guidance by skilled welding engineers and teachers. Practical training on welding hand eye coordination, machine and tool space and body space for engineers. Demonstrations on gauging, brazing, plasma welding, plasma cutting, submerged arc welding, resistance welding, friction welding, electron beam welding, laser welding, other processes.

CHMT7054A Research, Design and Synthesis in Materials Engineering (40 points)

Introduction to the general philosophy and approach to evaluating material/process research, designs and materials synthesis. The main steps leading to production/synthesis of a material will be covered, research methodology and technics, equipment selection, data analysis and interpretation.

In addition other topics to be covered will include:
Rapid prototyping, globalisation, the value chain, the importance of technology design & synthesis in small and medium enterprises, niche markets & marketing. Cost reduction by automation and mass production will be evaluated together with the economic and management skill required to successfully complete the design and synthesis process. Exposure to real life examples and experience. Students will be required to submit a full design project appropriate to materials engineering.

CHMT7055A Nanotechnology

Nanotechnology is a technology that owes its basis on the prefix nano, a Greek word, which means (dwarf) billionth \((1 \times 10^{-9})\) meter dimensions. It is a relatively new technology that deals, studies or possesses the ability to systematically organise and manipulate properties and behaviour of matter and even builds matter at the atomic and molecular levels. It may be seen as the next technological rush since the Silicon Valley outburst in electronic miniaturisation, and the emerging cutting-edge technology. It is certainly setting the pace for the creation of functional devices, manufacturing and fabrication, materials and systems at the molecular level, atom by atom, to create large structures with fundamentally precise and specific molecular organisation.

CHMT7057A Coal Combustion and Power Generation


**CHMT7058A  Coal Preparation and Beneficiation**

South African coal reserves and coal markets, exports; basis of beneficiation, applications and limitations of density-based processes; concepts of washability, plant efficiency; dependant and independent criteria of assessment of performance; surface dependant processes; novel beneficiation techniques; ancillary operation, plant design.

**CHMT7059A  Coal Conversion and Gasification**


**CHMT7060A  Coal and Carbon in the Metallurgical Industry**

Introduction to thermodynamics, 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, surface area; carbon-metal chemistry, reaction kinetics; transport phenomena; ferroalloy production, iron and steel making; trends in pyrometallurgical processes in relation to future carbon feedstocks. Additional uses of coal/carbon in metal processing.

**CHMT7062A  The Future of the Automotive Industry and Fuels**

Modules to be presented include:
Challenges facing the world
Evolution of the automotive industry
Evolution of automotive fuels
The future of automotive fuels

**CHMT7063A  Process Instrumentation and Control in Refining**

Modules to be presented include:
Refining introduction
Instrumentation of a distillation column
Digital control systems
Quality soft sensors
Possible controllers
Role of the engineer

**CHMT7064A  Introduction to Oil and Gas Production Corrosion Mechanism**

Modules to be presented include:
Internal metal loss corrosion
Hydrogen embrittlement
Control of corrosion
Monitoring of corrosion
External corrosion
Control of external corrosion
CHMT7065A  Oil Products and Refining

Modules to be presented include:
- The petroleum economy
- Hydrocarbons and oil products
- Oil products and environmental constraints
- Conventional fuels
- Combustibles
- Crude oils
- The refining process

CHMT7066A  Introduction to Oil and Gas Offshore Platforms/Pipelines

Modules to be presented include:
A – Energies: General, Fossil fuels, Nuclear Fuels, Renewables
B – Petroleum Industry: General, production facilities, terminology, Units, petroleum production and consumption, introduction to refining processes, the business of oil.
C – Petroleum industry actors: Petroleum companies, offshore players and companies
D – Platform structures (1): Platforms and mobile platforms
E – Platform Structures (2): Fixed platforms, deep sea platforms, estimated structure weight, safety and accidents, decommissioning.

CHMT7067A  Tribology: Friction, Wear and Lubrication

Introduction to the fundamentals of friction, wear and lubrication engineering. The main industrial applications and components which are subjected to friction and wear will be presented. These include gears, brakes, rolling and plain bearings, hydraulic systems, internal combustion engines, compressor operation, condition monitoring and oil filtration, materials selection and surface engineering. Case studies covering the application of these fundamentals to mining, quarrying and industrial equipment.

CHMT7068A  Underground Coal Gasification

Underground coal gasification is a clean coal technology, and the course is offered as an optional course in the suite of coal and energy courses currently run within the Faculty, and aims to attract students from many different disciplines. The course will cover the history of 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.

CHMT7069A  CO₂ Capture in Power Plants

South Africa is a coal based economy and it is crucial that we develop and apply suitable carbon capture technology to ensure a sustainable future by the reduction of carbon dioxide emissions. The course has been developed by a Norwegian university and is offered as an optional course in the suite of coal and energy courses currently run within the Faculty. It aims to attract students from many different disciplines. The course will cover 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 will be covered, as well as a consideration of energy penalties / efficiency reduction caused by CO₂ capture. Compression and
conditioning of CO₂ for transport and storage condition, and CO₂ storage will be briefly considered.

**CHMT7070A  Nanotechnology in Petroleum Reservoir**

Introduction to Nanotechnology of Oil & Gas  
Petroleum Chemistry  
Petrophysics  
Introduction to chemical reaction Engineering  
Catalysts and Catalysis  
Chemical Vapor Deposition  
Interfacial Mass Transfer  
Introduction to petroleum Reservoir Rock properties  
Nanotechnology and phase behavior of petroleum reservoir fluids  
Porosity and capillary pressure  
Nanotechnology of cavitation & pump selection

**CHMT7072A  Advanced Biochemical Engineering**

This course may cover the following topics:  
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  
Development and commercialisation of Bioprocesses

**CHMT7071A  Tribology of Materials**

The different wear mechanisms experienced by materials during industrial operation will be presented: sliding wear, abrasion, erosion, fretting wear, adhesion, surface fatigue wear, and corrosive wear. Factors influencing each mechanism and the test methods to assess the wear rates will be explained. Materials selection to limit the different wear mechanisms will be discussed.

**CHMT7073A  Design and Construction of Welded Structures under Static Loading**


**CHMT7074A  Design and Construction of Welded Structures under Dynamic Loading**

SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

CIVN1001A  Engineering Computing
(15) (2-0-1) (1 term)
This course is intended to provide an introduction to and develop the skills necessary to effectively use engineering computing tools: word processors, spreadsheets, presentation software, computer modelling tools and other software packages to be selected from year to year as they become available.

CIVN1004A  Engineering Skills (Civil)
(18) (4-2-1) (1 term)
English Component: Critical and creative thinking, reading and summarising; Verbal and written communication;
Graphics component: Engineering drawing standards and conventions; Freehand;
Geometrical construction: Orthographic, oblique, isometric and auxiliary projection;
Fundamental spatial relations: Intersections; Assembly drawings.
To pass this course, both the English component and the Graphics component must be passed.

CIVN1005A  Introduction to Civil Engineering Infrastructure
Qualifying course for BSc(URP)
Overview of engineering, civil engineering, development and infrastructure. Relationship between infrastructure provision and country income level and investment. 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). Overview of existing South African guideline books for infrastructure provision.

CIVN1997A  Practical Training (Civil)
Practical training at the end of first year for a minimum period of two weeks in the steel and concrete construction industry involving lectures, labs and site visits in the following, but not limited to, subjects: plant and associated maintenance; concreting; roads and earth works; shuttering and reinforcement; structural steel fabrication; building trades; and the construction procedure. In addition to the above, this course entails 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.

CIVN2000A  Earth Materials and Processes
(15) (3-1-1) (1 term)
Prerequisite: PHYS1015A
CIVN2003  Civil Engineering Theory I
Qualifying course for BAS (9 SAQA points)

CIVN2004A  Engineering Planning and Design
(15) (3-0-0.5) (1 term)
This course is aimed at formalising some aspects of the design process, using the context of civil and environmental engineering projects. Course content: creative thinking techniques, Engineering methodology, Modelling, Systems analysis, Decision-making, Scenario planning.
Prerequisites: All first-year courses

CIVN2007A  Economics and Management
(15) (3-1-0) (1 term)
Economics: The role of the construction industry in the economy; municipal integrated development plans; economic evaluation of infrastructure projects using techniques such as Net Present Value, cost-benefit, Internal Rate of Return.
Project Management: Introduction to the Project Management Body of Knowledge (PMBOK) including principles and techniques for the management of cost, time, scope, quality, human resources, procurement, communications, risk and integration; evaluation and application of standard engineering and construction contracts

CIVN2008A  Materials and Structures I
(15) (3-1-0.5) (1 term)
The actual behaviour of some of the materials used in civil engineering is described, 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. Similarly the way in which the behaviour of real structures can be assumed to be simplified is introduced. The individual subjects included are as follows:
Design: The design process, loading and forces on structures and members. Design methods, safety factors.
Prerequisites: MATH1014A, PHYS1015A

CIVN2009A  Materials and Structures II
(15) (3-1-1) (1 term)
The individual subjects included are as follows:
Structural engineering: Deflection of statically determinate structures by integration, moment area and energy methods. Influence lines.

Prerequisites: MATH1014A, PHYS1015A

CIVN2010A  Numerical Methods

(15) (3-1-0.5) (1 term)

Introductory concepts: Errors, limitations of finite precision machines, error quantification; Solutions of Equations: Bisection, linear iteration, Newton-Raphson, Aiken’s acceleration algorithm; Functional Interpolation: Interpolation with various functions, their merits and demerits, polynomial interpolation, Lagrange interpolation, Chebyshev polynomials, least square interpolation; Numerical Integration: Trapezoidal, Simpson, Newton-Cotes, Gaussian; Solutions of eigenvalue problems: Evolution of such problems in engineering; methods of solution; Solution of ordinary and partial differential equations (ODEs & PDEs): 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; Computer coding of some algorithms in a language required of students.

Prerequisite: MATH1014A

CIVN2011A  Probability Theory and Mathematical Statistics for Engineers

(15) (3-1-0) (1 term)

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.

CIVN2012A  Civil Engineering Theory I (CS)

Qualifying course for BSc(CS)

This course introduces students to the concept of loading and analysis of structures with particular emphasis on equilibrium, basic design of reinforced concrete, steel and timber structures. Course contents are as follows:

PART 1A:
Introduction to structures: Forces and moments, Material properties, Self-weight, Pressures, Soil pressures, Floor loads, Beam and column loads, Wind loads, Thermal loads, Overturning and instability of structures, Deflections.

Forces and stresses in members: Equilibrium equations of forces and moments, Components of forces and moments about a point.

Structures in which axial forces are dominant: calculation of reactions and member forces, as well as allowable and applied axial stresses in trusses, suspension structures, arches, bracing and columns, Structures in which bending moments, shear force are dominant. Calculation of reactions and bending moments, shear force diagrams as well as allowable and applied bending and shear stresses in beams and frames.

Structures in which axial forces and bending moments are important: arches, unbraced frames.

PART 1B:
Concrete design: General concepts, Loads and member forces, Beam design, Slab design, Column design, Foundation design.

Steel design: Layout and framing applied loads and steel properties, Design of tension members, compression members, beams, trusses, bracing, columns, and beams-columns.

Sheeting and purlins Connections.
Timber design: Material properties, Design of tension members, Design of compression members, Beams and connections.

**CIVN2013A  Introduction to Environmental Engineering**

(15) (3-1-0) (1 term)

This course introduces the most critical elements of environmental engineering and environmental health and safety to second year civil engineering students. The course provides a fundamental basis from which to understand and evaluate the environment and design engineered systems for environmental quality control. These systems include water and wastewater treatment, air pollution control, soil and aquifer pollution and 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 will be incorporated into the course in lectures and especially through recitations and special seminars.

**CIVN1998A  Vacation Work I (Civil)**

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 on constructional work or in a drawing office concerned with such works, and should be according to the departmental guidelines for vacation work.

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.

**CIVN3001A  Construction Materials I**

(15) (3-1-1) (1 term)

Two dimensional stress and strain analysis; elastic stress-strain functions. Shear stresses in beams; Shear centres. Torsion. Reinforced and prestressed concrete. Basic concrete technology. Laboratory projects.

*Prerequisites:* CIVN2008A, CIVN2009A

**CIVN3004A  Geotechnical Engineering I**

(15) (3-1-0.5) (1 term)

Scope of geotechnical engineering. Simple soil properties; classification of soils. Total and effective stresses; shear strength. Soil profiles and site exploration. One-dimensional seepage of water through saturated soil. Lateral earth pressure on structures; retaining walls. Bearing stress distribution by elastic theory; ultimate bearing capacity. Laboratory work.

**CIVN3005  Civil Engineering Theory II**

Qualifying course for BAS (9 SAQA points)

*Structural Engineering Theory:* Limit states design: load and resistance factors, analysis of member strengths and associated section properties; assessment of deflections: introduction to instability; description of indeterminate structures.

*Design Aspects:* Limit states design of case studies of steel and concrete structures; design of masonry structures.

*Application to Design:* Evaluation of design, construction and cost evaluation of third year design project.
**CIVN3010A  Structural Steel Design**

(15) (3-1-1) (1 term)

Loading, Tension members, Compression members, Shear, Combined stress members, Base plates, Stability, Beams and plate girders, Trusses and frames, Connections, Beam-column design, Layout drawings, Design project.

**Prerequisites:** CIVN2008A, CIVN2009A

**CIVN3011A  Reinforced Concrete Design**

(15) (3-1-1) (1 term)

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, CAD packages

**Prerequisites:** CIVN2008A, CIVN2009A

**CIVN3012A  Hydrology**

(15) (3-1-0.5) (1 term)

Introduction, Hydrological cycle, Hydrologic systems concepts, hydrologic modeling concepts; Water resources of Southern Africa, nature of problems and issues, water availability, water demands; Rainfall: types of rainfall, rainfall measurement, characteristics. depth-duration-frequency relationships, spatial variability, averaging techniques; Evaporation and transpiration: meteorological processes, estimation and measurement of evaporation, transpiration and evapotranspiration rates; Infiltration: Phi index method, Horton’s method, Green-Ampt method; Groundwater: occurrence, movement, well hydraulics; Storage-yield analysis: Reservoir sizing; Flood frequency analysis: review of statistical concepts, frequency factor analysis, graphical analysis, confidence limits; The Rational method: concepts of concentration time and rainfall duration, design applications; Unit Hydrographs, theory, unit hydrograph application, synthetic unit hydrographs; Flood routing, time-area catchment routing, reservoir routing, Muskingum river routing.

**Prerequisites:** CIVN2010A, CIVN2011A

**CIVN3013A  Basic Hydraulics**

(15) (3-1-0.5) (1 term)


**Prerequisites:** All first year courses, CIVN2010A, MATH2011A or MATH2012A

**CIVN3014A  Structural Engineering IA**

(15) (3-1-1) (1 term)

Introduction: Overview of the topics covered and how they fit together; Equilibrium: Summary and recap of equilibrium and how it is used; Influence Lines: An explanation of what the Influence Line (IL) is made. The method of determining the IL is presented. Several examples are then covered; Principle of Virtual Work: This principle is introduced. The equation is derived. Several examples are then covered; Muller-Breslau Principle and Model Analysis: This principle is first stated. The equation behind the principle is derived. Several examples of various structures (beams, frames, arches, trusses) are then covered. The application to model analysis is explained; Computer Methods: Local and global axes systems are introduced. The method of rotating one axes system to the other is derived. The matrix method of analysis is derived. The following
structural types are considered in detail: trusses, two-dimensional frames, two dimensional grillages. Both the theoretical workings, and a detail example with all the workings is presented for each structure type.

Prerequisites: CIVN2008A, CIVN2009A

CIVN3015A Structural Engineering IB

(15) (3-1-1) (1 term)

Introduction: Overview of the topics covered and how they fit together; Principle of Virtual Work: This principle is summarised (from Structures IA). Several examples are then covered. This course concentrates on both determinate and indeterminate structures; Static and Kinematic Indeterminancy: 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. Examples of determinate and indeterminate structures are covered in class; Stiffness Methods: Stiffness principles are considered. The Stiffness Method of analysis is introduced. Examples are covered in class of determinate and indeterminate structures. How the Stiffness Method ties in with computer methods of Structures IA is explained. Special problems that include temperature effects and settlement of foundations will be presented; Stability of Structures: The concept of buckling will be presented. Linear elements (beams and struts) will be considered. Several methods, both analytical and numerical will be introduced. Examples will be worked through.

Prerequisites: CIVN2008A, CIVN2009A

CIVN3016A Infrastructure Planning and Management

(15) (3-1-0) (1 term)

Infrastructure – definitions, types and examples; contribution of infrastructure to economic growth and development; demographics; urbanisation; land use; overview of guideline documents for municipal infrastructure (i.e. The Red Book); participatory approaches; road hierarchies and characteristics; design of municipal infrastructure (especially road design); infrastructure maintenance planning; tendering and estimating; employment creation in road construction; constructability.

CIVN3017A Systems Analysis and Optimisation

(15) (3-1-0) (1 term)

Basic systems analysis: the need for systems analysis, systems and processes, components of a system, system modeling and analysis, system simulation; Introduction to optimisation: Examples of engineering problems that require optimisation, Formulation and components of an optimisation problem, Solution techniques of optimisation problems, Examples of real life applications; Linear Programming (LP): Graphical solution to LP problems, solution of a system of linear equations, general systems of linear equations, formulating LPs into standard form, basic solutions from standard form LP, location of basic solutions in graphical representation of LPs, general steps of the simplex method, examples of LP solutions using the simplex method, the dual simplex method, special cases/problems, solving LP problems using EXCEL, sensitivity analysis including a graphical introduction, using EXCEL for sensitivity analysis; Dynamic Programming: Introduction, characteristics of a DP problem, recursive equations in DP, solving DP problems manually and on spreadsheets; Network Models: Basic definitions, shortest path problems, maximum flow problems, Critical Path method (CPM), Example of CPM; Genetic Algorithms: Introduction-how the GA works, general steps of the GA, solving GA problems manually, Example real-life problems solved by the GA; Decision making under uncertainty: The need for decision making under uncertainty, Decision making without experimentation, decision making with experimentation, decision trees, utility theory;
Markov Chains: Stochastic processes, defining a Markov Chain, multiple (n) step transition probabilities, classification of states of a Markov Chain, steady state probabilities; Markov decision processes (MDP): Introduction, MDP solution model, solution by exhaustive enumeration, solution by linear programming, solution by policy improvement algorithm.

Prerequisites: CIVN2010A, CIVN2011A

CIVN3019A  Civil Engineering Theory II (CS)
Qualifying course for BSc(CS)
The course contents include the following:
PART 2A: Limit states design of concrete, steel and timber structures; Loads and resistance factors; Analysis of member strength and associated section properties; Steel and timber connection design; Assessment of deflections; Introduction to instability; Description of indeterminate structures.
PART 2B: Design Aspects: Limit states design of case studies of steel and concrete structures; Design of unreinforced masonry structures.
Application to Design: Evaluation of design, construction and cost evaluation of third year design projects.

CIVN1999A  Vacation Work II (Civil)
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 on design work and should be according to the departmental guidelines for vacation work.
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.

CIVN4000A  Construction Materials II
(21) (3-1-8) (1.5 terms)
Prerequisite: CIVN3001A

CIVN4002A  Structural Engineering II
(21) (3-1-8) (1.5 terms)
Prerequisites: CIVN3014A, CIVN3015A

CIVN4003A  Civil Engineering Design III
(27) (2-0-0) (1 block)
Planning and design of civil and environmental engineering works; associated reports; specifications and bills of quantities; aspects of professional practice.
Prerequisites: All third-year units and a minimum number of CPD points from seminar attendance
**CIVN4004A  Geotechnical Engineering II**

(21) (3-1-0.5) (1.5 terms)


Prerequisite: CIVN3004A

**CIVN4005A  Investigational Project**

(27) (0-1-0) (1.5 terms)

Project of an investigational nature, carried out either as an individual or as a member of a small team. Assignments on professional communication.

Prerequisites: All third-year subjects

**CIVN4006A  Integrated Resource Management**

(21) (3-0-0) (1.5 terms)

This course consists of four components as follows: (1) Motivation for Integrated Resources Management and the Sustainable Development approach to resources/problems. (2) Integrated Catchment Management: Water resources; Management in time and space; Multi-disciplinary approach; Legal, social and economic factors; supply and demand; SA perspective.

(3) Urbanism: Rapid urbanisation and informal settlements; SA municipal policy and legislation; applications of integrated municipal infrastructure.

(4) Environmental Management: Environmental management principles, environmental management tools and methods; environmental impact assessment.

**CIVN4007A  Civil Engineering Theory III**

Qualifying course for BSc(Construction Management)

The course is divided into two modules each with its own syllabus.

**Geotechnical Engineering**

Scope of geotechnical engineering. Problems of equilibrium and deformation. Simple soil properties; classification of soils and rocks. Soil profiles, site exploration, drilling and sampling. Introduction to shear strength, settlement, bearing capacity, slope stability, earth pressure. Laboratory work.

**Materials**


**CIVN4010A  Hydraulic Engineering**

(21) (3-1-1) (1.5 terms)

Open Channel flow: Introduction, Uniform flow; Rapidly varied flow, Specific energy; Critical flow, Controls, Momentum equation, Hydraulic jump, Gradually varied flow, Profile classification & synthesis, Gradually varied flow computation – numerical step methods.
Hydraulic structures: weirs, flumes, underflow gates, spillways, stilling basins and energy dissipators. Brief review of municipal storm drainage systems design; design of inlets and culverts. 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.

Prerequisites: CIVN3012A, CIVN3013A

**CIVN4013 Civil Engineering Theory in Construction**

Qualifying course for BSc(Hons) (Construction Management)

The course introduces students to both geotechnical engineering and construction materials. Topics taught include:

(i) Geotechnical engineering:

Soil properties, Soil classifications, Soil profiles; Site investigation; Effective stresses, Shear strength; Compaction, Road design; Lateral pressures; Seepage; Bearing capacity; Foundations.

(ii) Construction Materials:

- Fundamentals of material behaviour: Performance criteria; elastic stress-strain functions; creep, shrinkage and relaxation; fatigue
- Intermediate concrete technology: Hydration chemistry; binder types; concrete durability
- Concrete quality: Statistical approaches to monitoring and controlling concrete quality
- Fire and explosions in buildings.
- Metallurgy and corrosion: Basic introduction to the processing of metals and steel and the effects on engineering properties; corrosion technology – principles and prevention
- Fibre reinforced materials: Basic introduction to the analysis, processing and applications of fibre reinforced materials.

**Postgraduate courses**

*(All courses 20 credit points unless otherwise indicated)*

**CIVN7000A Non-linear Analysis of Structures**


**CIVN7005A Dynamic Loading and Analysis of Structures**

Classical and computer methods of analysis of the vibration of single and multi degree of freedom structures, as well as 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. Human and machine tolerance to vibration will also be considered.

**CIVN7006A Employment Creation in Road Construction and Maintenance**

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; implications in South African context.

**CIVN7007A  Employment Creation in the Construction and Maintenance of Infrastructure**

*Please note that this is a different course from “Employment Creation in Road Construction and Maintenance”.*

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; dam construction, irrigation projects, road construction, municipal infrastructure (roads, water supply, sanitation, storm water drainage).

**CIVN7012A  Advanced Design of Structural Steel**


**CIVN7013A  Waste Water Engineering**


**CIVN7016A  Hydraulic Structures**


**CIVN7018A  Project Management in Construction**

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.

**CIVN7020A  Project Management in Developing Areas**

Basic theories of development economics; cultural and sociopolitical factors; issues and problems in the management of development projects; basic principles of project management as applied to the management of construction projects in developing areas.
CIVN7021A  Advanced Geotechnical Site Investigation

Principles and techniques of site investigation, soil profiling, identification and classification of soils. Principles of operation of vane shear, cone penetrometer, plate loading and pressuremeter tests. Load tests on piles, dynamic measurements on piles. Field work: will depend on cooperation with local geotechnical testing organisations – intention is to provide field practice in soil profiling and at least two of field test methods. Geophysical methods. Pressuremeter tests.

CIVN7022A  Advanced Geotechnical Testing

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. Testing of rock samples.

CIVN7023A  Deep Foundations and Anchors


CIVN7024A  Environmental Management


CIVN7025A  Construction Site Management

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. Plant Management.

CIVN7026A  Analysis and Design of Shell Structures

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. Laboratory work.

CIVN7027A  Theoretical Soil Mechanics


CIVN7028A  Earth Pressures and Retaining Structures


**CIVN7029A  Urban Engineering Context**

**CIVN7030A  Science and Technology Policy for Development**

**CIVN7033A  Water Quality Modelling**

**CIVN7035A  River Hydraulics**

**CIVN7036A  Finite Element Analysis of Structures**
This course will examine the theory and practical application of finite elements. Beam elements, plane stress and plane strain elements, plate bending elements, and brick elements will be theoretically derived. The practical application of finite elements, non-linear theory, modelling of reinforced concrete structures and the modelling of composite structures will be discussed. Several assignments will be set giving the student an opportunity to analyse common structural problems.

**CIVN7038A  Project Management - Part I**
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. Issues in Project Management.
CIVN7039A Project Management - Part II
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.
Prerequisite: CIVN7038A Project Management – Part I

CIVN7042A Selected Topic
A selected topic is a research-based assignment as approved by the Postgraduate Coordinator.

CIVN7044A Pollution Prevention and Abatement
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.

CIVN7045A GIS Applications in Environmental Planning, Management and Decision-Making
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, cost of initiating GIS.

CIVN7046A Advanced Prestressed Concrete Design
This course aims to provide both basic and in-depth understanding of the behaviour of prestressed concrete structures at both service and ultimate load conditions. The application of prestressed concrete elements with particular reference to bridge design will form part of the discussion. The course will consist of 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, composite (prestress + in-situ) beams.

CIVN7047A Advanced Reinforced Concrete Design
This course is designed to provide an understanding of the methods of analysis and design of reinforced concrete structures. Aspects of the code SABS 0100 will be discussed with design examples and comparison made with other international codes. The course will consist of 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. Application: RC frame/shear wall construction.
CIVN7048A Design Project (40 points)
There is no syllabus for this course, a design project. Details will be supplied by the postgraduate co-ordinator of the School. Professional competence development design project for the Master of Engineering (M.Eng).

CIVN7049A Investigational Project (40 points)
This course consists of a project in which a problem or topic is investigated and recommendations regarding the solution are made. A comprehensive report is required. Professional competence development investigational project for the Master of Engineering (M.Eng).

CIVN7051A Introduction to Industrial Ecology
This course is intended to provide an introduction to Industrial Ecology and the principles, tools and techniques it uses. Industrial Ecology (IE) is seen as a model for achieving industrial sustainability through systematic planning of industrial activity. Indeed, where IE principles, or at least their components are applied, it is evident that immediate benefits from improved economic performance have the greatest influence and are seen as supporting long term sustainability through planned symbiotic interactions within the industrial systems other organisations.

Industrial ecology (IE) is a framework for proactive management of human impacts on the natural environment and is emerging at a time when traditional de-pollution approaches (end of pipe) are increasingly regarded as inefficient. IE can be regarded as implementation of another philosophy, i.e. ecologically sustainable development which focuses on borrowing ecological principles and applying them to the design and management of commercial systems, and the infrastructure required by them.

CIVN7053A Design for the Environment
Rather than paying a steep price for environmental improvement, we can redesign our industrial systems to achieve both environmental quality and economic efficiency. That is the premise of this course that sets forth the underlying rationale and methodology for Design for Environment, an emerging business practice that has captured the attention of many leading product development organisations. Design for Environment provides a powerful, integrative approach whereby designs can simultaneously increase the profitability of the products and services and benefit the global environment. Design for Environment provides a pragmatic tool for fulfilling the principle of sustainable development through the development of eco-efficient products and processes.

The purpose of this course is to provide both an informative introduction and a useful foundation to those who wish to apply Design for Environment principles and methods. It reviews many concrete techniques, guidelines, and examples that will help to educate product development teams, both veterans and novices, about the practical aspects of Design for Environment. It emphasises 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. At the same time it provides a sweeping overview of the cultural, political and economic changes that are transforming the role of environmental management in the business world.

CIVN7054A Air Resources Engineering
This course is intended to provide a brief overview of the nature and effects of air pollutants on the biosphere, and the legal requirements with regard to permitted emission levels. The main focus of the course is to provide the specialist knowledge and skills required to select and implement air pollution abatement technologies. The course encourages a philosophy in which air elimination is a design criterion.

The main objectives of the course are:
• To develop an understanding and awareness of air pollution and technologies available to reduce and eliminate pollution.
• To equip students to obtain and analyse the data required to identify and monitor air pollution.
• To select and implement suitable technology for air pollution control.
• To develop an understanding of design philosophy and approach to solving pollution problems before a new design is finalised.

**CIVN7055A Investigational Project - Geotechnical/ Materials Engineering (40 points)**

This course consists of a project in which a problem or topic is investigated and recommendations regarding the solution are made. A comprehensive report is required. Professional competence development investigational project for the Master of Engineering (M.Eng).

**CIVN7056A Design Project - Geotechnical/ Materials Engineering (40 points)**

There is no syllabus for this course, a design project. Details will be supplied by the postgraduate co-ordinator of the School. Professional competence development design project for the Master of Engineering (M.Eng).

**CIVN7058A Rural Water Supply and Sanitation**

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.

**CIVN7059A Water Management**

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. Institutional and legislative aspects of water management.

**CIVN7060A Hydraulic Modelling**

What is 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. Application of available computer hydraulic software to flow problems.

*Prerequisite:* CIVN4001A

**CIVN7061A Water Supply and Urban Drainage**

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, stormwater drainage management. Computer models for water supply and urban drainage.

**Prerequisite:** CIVN4001A

**CIVN7062A Design of Masonry Structures**

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, Developments in SA and European Codes and Standards.

**CIVN7063A Chemistry, Durability and Performance of Concrete in Structures**

Role of chemistry in concrete. Chemistry of cement, chemical admixture interactions, extender effects.


**CIVN7064A Advanced Concrete Technology**


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, chemical analysis of hardened concretes.

**CIVN7065A Water Resources Planning**

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.


River Basin Planning Models: Modelling the Natural Resources System and Related Infrastructure, Modelling the Socio-Economic Functions in a River Basin, River Basin Analysis.

**CIVN7066A Durability, Assessment and Repair of Concrete Structures**

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 will be presented. Students will be required to complete an exam and a project report that may involve a lab experiment, literature review or field case study.

**CIVN7068A Environmental Engineering Design**

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; design for minimising construction waste.

**CIVN7069A Managing the Environmental Impact of a Nuclear Energy Project**

- 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
  - Rehabilitation of the environment
- The environmental stewardship of a nuclear project from inception of the project to final release after rehabilitation of a site
SCHOOL OF COMPUTER SCIENCE AND APPLIED MATHEMATICS

APPM1000 Applied Mathematics (Arch)
Qualifying course for BAS (5 SAQA points)
Vector algebra, systems of coplanar forces, transversely loaded beams, frameworks, centres of gravity.

APPM1022A Introductory Statistics for Construction
Qualifying course for BSc(CS)
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).
Combinatorics: The symbol n!; mutually exclusive events; the fundamental laws of counting; permutations and combinations.
Probability: Theoretical probability; dependent and independent events; the laws of probability; empirical probability.
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.
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.
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.
Inferential Statistics: Estimation Theory: Overview; estimation theory; confidence intervals for normally distributed statistics; confidence interval for the population proportion.
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).
The Student’s t-Distribution: the student’s t-test; difference of means.
The χ² Distribution: the χ² Test; Definitions; testing distributions; two-way cross-classifications.
The F-Distribution: Applications; comparing population variances.
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.
Computing: Statistical analysis of data using spread sheets.

APPM1023A Mathematical Techniques for Planners
Qualifying course for BSc(URP)
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.

**APPM2013A Biomedical Statistics and Numerical Methods**

(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.

**APPM2014A Applied Mathematics IIA**

(18) (4-2-0) (1 term)
Linear differential equations with constant coefficients; simple harmonic motion; vertical oscillations of a particle hanging on an elastic string; damped oscillations; forced oscillations; moments of inertia; rotation of a rigid body; matrix methods - systems of oscillating particles; difference equations; partial differential equations - waves in a stretched elastic string - Fourier Series - heat equation; selected engineering computer simulations illustrative of the heat flow and other partial differential equations.

*Prerequisite:* PHYS1015A

**APPM3021A Computational Mathematics**

(15) (4-1-0) (1 term)
Objective: The student will obtain an understanding of the concepts, limitations and advantages of using computers in carrying out mathematical computations.


*Prerequisite:* MATH2014A

**APPM3036A Quantitative Methods for Planners**

Qualifying course for BSc(URP)
This course is designed as an introduction to basic statistical tools and quantitative methods for students in urban planning. Elementary statistics, probability, and other types of quantitative reasoning useful for description, estimation, comparison, and explanation are covered. Emphasis is on the use and limitations of analytical techniques in planning practice. This unit covers topics including introductory statistics, gravity models, curve fitting and interpolation, and population growth models. Examples and homework problems are chosen to relate statistical methods to issues of substantive interest to planners, in most cases using real-world data.

**SCHOOL OF COMPUTER SCIENCE**

**COMS2004A Data Structures and Algorithms**

(18) (4-1-1) (1 term)
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.
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.

Prerequisites: MATH1014A, ELEN1000A
Corequisites: ELEN2004A

SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT

BUQS1004A Construction Drawings

Qualifying course for BSc(CS)

The aim of the course is to equip the student with the skills to convert 2-D concepts into physical 3-D models as well as develop an understanding of what the production of graphical design information, and documentation, entails, and to be familiar with industry practice in the notation and conventions used in 2D representations. 2-Dimensional and 3-Dimensional model building will be introduced as tools to aid in the management of the design process, the understanding of construction drawings, and the assembly of industry standard construction drawings including the conversion of all documentation into functional BIM models.

BUQS1005A Construction Materials and Environment

Qualifying course for BSc(CS)

Section 1
Introduction to environmental science, emphasizing climatology, ecology and geology concepts, and how they affect or are affected by activities and processes in the built environment; environmental impact of extraction and production processes of construction materials.

Section 2
Materials used in construction (e.g. Stone, lime and cement, bricks, blocks, concrete and mortar, timber, ceramics, metals, glass, polymers, plastics, adhesives and sealants, bituminous products, plastics and rubbers); properties of construction materials, and how they are used; innovative materials used in construction

BUQS1006A Construction Technology I

Qualifying course for BSc(CS)

The technology of construction of simple residential and commercial buildings. This includes basic soil investigation, setting out of internal and external foundations, superstructure, walling, arches, fireplaces, roofs, dome roofs, openings (doors and windows), joinery fittings, ironmongery and finishes. Tools and equipment for simple construction. National building codes and regulations.

BUQS1007A Communication Skills

Qualifying course for BSc(CS) and BSc(Property Studies)

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.
Communication: communication principles, audience, planning and organization styled tone, vocabulary, oral messages, writing, reports, theses, letters, graphs, readability, documentation and presentations. Computer appreciation and introduction to information and communication technology.

**BUQS1008A  Quantities and Specifications I**
Qualifying course for BSc(CS)
Documents in Construction contracts, such as drawings and specifications; The objects and benefits of bills of quantities; Introducing the principles, and standard systems of measurement; Tools and protocols of measurement; Taking off simple building elements and the quantification of a simple residential building from drawings, including squaring, abstracting and billing; Theory and methods of describing items in bills of quantities and preparation of specifications for simple building elements; The role of the quantity surveyor and other professionals in the built environment.

**BUQS1009  Real Estate Principles**
Qualifying course for BSc(Property Studies)
Learning objectives: After the course, participants should be able to identify elements of the built environment and explain the needs that drive the built environment. They should also be able to 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). The course will discuss the nature and characteristics of real estate markets, the rights inherent in real estate ownership and how these rights can be transferred; the roles of the actors in the real estate sector.

**BUQS1992A  Practical Experience I**
Qualifying course for BSc(CS)
The aim of this course is to provide learners with practical experience and exposure to construction processes, technologies, materials, management, ethical issues and construction health and safety.

**BUQS2003A  Building Science I**
Qualifying course for BSc(CS)
Introduction to building science; Climate and the building environment; Energy sources and use in buildings; Principles of heat and thermal insulation in buildings; Air control in buildings, eg ventilation, humidity and condensation in buildings; Principles of light, natural lighting in buildings; Principles of sound and sound control; Principles of water technology and fluid flow; Water sources, supplies, treatment, and distribution; Plumbing and drainage; Sewers and sewer treatment; The science of fire and fire protection in buildings.

**BUQS2004A  Construction Technology II**
Qualifying course for BSc(CS)
Construction of high-rise buildings, industrial buildings and civil engineering structures using reinforced concrete, steel and timber while conscious of health and safety issues: Advanced soil investigation; Advanced foundations, including rafts, pads, piles; Basement construction, retaining walls; water proofing; Construction in reinforced concrete, beams, columns, floors, ribbed floors; Pre-tension and post tension construction; Formwork design and construction; Scaffolding and shoring; Structural steel construction, stanchions, Universal beams and columns, composite steel structures, trusses, girders, castalle ted
beams, steel connections, such as welding, bolting, riveting; Portal frames in Reinforced concrete, steel and timber; Fire protection for steel structures.

Building finishes on floors, walls, (plastering, renderings, tiling and Mosaic) suspended ceilings and roofs their choice and how they are installed, cladding and curtain walls, Components; Glazing, Balustrades, iron mongery Partitions and drywalls, demountable partitions; Openings, doors and windows and installations; Joinery Fittings in buildings all for highrise construction

**BUQS2005A  Quantities and Specifications II**

Qualifying course for BSc(CS)

The course involves measurement and specification writing for buildings from simple to complex; Measurement (taking off) and description of quantities from drawings and specification for simple commercial buildings; Measurement (taking off) and description of quantities from drawings and specifications for high rise buildings to include reinforced concrete, finishes, openings, roofing and roof finishes, cladding and curtain walls, fittings all for high rise buildings.

**BUQS2006A  Site Management**

Qualifying course for BSc(CS)

Introduction to site management; Nature of a construction project; Site management practice eg Site organization, site layout and planning, site security, Hoarding and fencing, site safety, site administration, site communication, plant and materials control, industrial relations, managing sub-contractors; Innovations and technologies for site management, issues and trends in site management.

Different plant and equipment in construction such as Earthmoving plant, Excavation, transport, Concrete Plant, Concrete distribution plant, pile driving plant, Cranes, Hoists, Compressed air Plant, pumps and dewatering equipment. Construction Methods and general Considerations in the selection of plan, Decision-making: hiring or purchasing of construction machinery; Health and Safety issues. Plant productivity, factors affecting plant productivity; The Economics of life cycle cost and analysis of plant, plant Management and maintenance, Depreciation and analysis.

Legislation and laws that relate to health and safety, health and safety risk management, policy and planning for health and safety. Principles of control, monitoring and audit. Incident investigation recording and reporting. Hazards and control: construction site, plant and equipment, electrical fire, chemical and biological, psychological health, working at heights, demolition; innovation in health and safety.

**BUQS2007A  Property Studies I**

Qualifying course for BSc(CS)

The course covers the basic principles of property valuations with emphasis on residential property valuations.

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.

**BUQS2008A  Accounting Principles in Construction**

Qualifying course for BSc(CS) and BSc(Property Studies)

1) The nature and role of accounting in business

Business needs of an accounting system.

Three classes of users of accounting information.

Various forms of ownership and the different types of business.

The definition of Accounting.
The qualitative features of accounting and the underlying assumptions in the recording of transactions and the preparation of financial statements.
The difference between the viability of a business and the need for a proper cash flow in order to meet the immediate cash needs of the business.
An understanding of the role of the three major financial statements.
Concept and understanding of the logic of the accounting equation.

2) The Elements of Double-Entry Bookkeeping
The accounting process
The meaning of the term transactions and to distinguish between internal transactions and external transactions linkages between the accounting equation and the system of debits and credits used in double entry bookkeeping.
The purpose and structure of a journal.
The purpose and structure of the general ledger causal linkage between the analysis of transactions, entries in the books of account, and the preparation of financial statements.
Principles of how a set of books can be kept on a computerised accounting system.

3) The Statement of Financial Position
The accounting conventions used in the preparation of a Statement of Financial Position.
The requirements of IAS 1 relating to the format of and information reflected in the Statement of Financial Position.
The form and function of the Statement of Financial Position and statement of changes in owner’s equity.
The limitations of a Statement of Financial Position.
Relevant issues concerning the recognition of property plant and equipment especially the measurement at recognition.

4) The Statement of Comprehensive Income
Relationship between the accounting equation, the Statement of Financial Position and the statement of comprehensive income.
Requirements of IAS 1 relating to the format of and information reflected in the Statement of comprehensive income.
Recognition criteria of income and expenses
Recognition and measurement principles relating to inventory
Relationship between cost, gross profit and selling price
The composition of cost of sales in a periodic stock system.
The various cost formulae applicable to inventories
The process for estimating the value of closing inventories
Form and functions of the statement of comprehensive income
Distinguish between a trading and service undertakings statement of comprehensive income.
The accounting conventions used in the preparation of an statement of comprehensive income.
Internal adjustments and how to process them.
The need for depreciation, the factors involved in its calculation and the various methods of depreciation.
The procedure for the disposal of an intangible asset
The principle features of the perpetual and periodic stock methods
The composition of the cost of inventory
The procedure adopted to close income and expense accounts

5) Accounting for Partnerships
Legal framework of a partnership and how this affects the accounting for a partnership.
The ledger accounts applicable to partnerships
How profits/losses are shared in partnerships.
How to analyse and interpret the financial statements of a partnership
6) Budgeting
The need for businesses to prepare budgets.
The nature, use and limitations of budgets.

**BUQS2009  Econometrics for Property Studies**
Qualifying course for BSc (Property Studies)
The goal of this course is to provide students with working knowledge of mathematical and statistical tools used in analyzing issues in property studies. In order to do this, students will be taken through 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

**BUQS2011  Real Estate Market Analysis**
Qualifying course for BSc(Property Studies)
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.

**BUQS2012  Real Estate Law**
Qualifying course for BSc(Property Studies)
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.

**BUQS2013A Urban Economics**
Qualifying course for BSc(Property Studies)
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 organized 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.

**BUQS2014  Real Estate Corporate Finance**
Qualifying course for BSc(Property Studies)
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 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; Real Options

**BUQS2015A  Building Technology I**

An appreciation of the construction industry; its size and role in the economy. An overview of the construction industry’s structure; its participants and their roles and responsibilities. An understanding of the construction assembly process associated with simple buildings, together with an appreciation of the relationship between design, technology and assembly. Familiarity with industry practice in the notation and conventions used in 2D representations. The technology of construction of simple residential and commercial buildings. This includes 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. National building codes and regulations

**BUQS1993A  Practical Experience II**

Qualifying course for BSc(CS)

The aim of this course is to provide learners with practical experience and exposure to construction processes, technologies, materials, management, ethical issues and construction health and safety.

**BUQS3004A  Construction Technology**

Qualifying course for BSc(QS), BSc (QSS), BSc(CM), BSc(CMS) and BSc(Property Studies)


**BUQS3011A  Professional and Research Skills**

Qualifying course for BSc (Construction Studies) and BSc(Property Studies)

Annotated bibliography, Literature reviews and referencing, Research topics, Problem statements, Research questions, Academic communication, Logical arguments and Proposals.

**BUQS3012A  Quantities and Specifications III**

Qualifying course for BSc (Construction Studies)

Measurement and description of quantities and specifications for specialized facilities such as construction of steel, reinforced concrete in bridges, retaining walls. Measurement of civil engineering structures, eg roads, tunneling, 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.
BUQS3013A  Construction Technology III

Qualifying course for BSc (Construction Studies)

Advanced construction, Underpinning and shoring and dome construction; construction of industrial buildings. Industrialised buildings; System buildings, Mechanized construction, Innovations in construction.

Introduction to infrastructure development, infrastructure and the environment, environmental impact assessment, types of infrastructure, engineering and services (e.g. advanced earthworks; control of ground water, piling, diaphragm and retaining wall systems). 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 infrastructure; Education infrastructure; Military infrastructure.

BUQS3014A  Estimating and Analysis of Prices

Qualifying course for BSc (Construction Studies)

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, eg air conditioning, lifts and escalators; Tendering and Tender strategy.

BUQS3015A  Management Principles in Construction

Qualifying course for BSc (Construction Studies)

Introduction to management concepts to include, evolution of management thought, planning, systems thinking, organizing, monitoring and control, communication, leadership, motivation and delegation, including innovative concepts in management.

Introduction to operations research, critical path scheduling and cost and time optimization, linear programming, transportation, queuing theory, decision theory and management games.

Application of these concepts in the construction environment.

BUQS3016A  Building Science II

Qualifying course for BSc (Construction Studies)

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; Adherence to the wiring code of practice

Acoustics

Basic acoustic theory; Room acoustics; Building acoustics; Noise quantification and control

Air Conditioning

Air conditioning theory; Difference types of air conditioning systems; Calculation loads; Specification of systems

Lifts

Lifts design and installation
BUQS3018A  Introduction to Construction Management

Qualifying course for BSc (Construction Studies)

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; Sources of funding.

Types of funding arrangements for a project development

Introduction to construction management, the role and functions of a construction management, construction management as a profession versus contracting; Company organizational structures, departments of a construction related companies and their functions.

Construction planning and business development for construction related companies; Market planning and tools of marketing for construction related companies; The business development process for construction and appraisal of business models for construction related companies.

BUQS3020A  Property Studies

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;

Sources of funding and basic funding arrangements for a property development

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.

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.

Income producing property valuations, discounted cash flows and net present value in the property environment.

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

The course covers the basic principles of property valuations with emphasis on residential property valuations.

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

BUQS3026A  Building Services

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
BUQS3027A  Building Technology II
Nature of the demand for construction services and its linkages to the wider economy. The construction procurement and project delivery process. Different structural forms; shells, frames and solid buildings, multistory buildings, function and constraints on technology choices, health and safety legislation and the responsibilities of clients, knowledge of construction of industrialized buildings and industrialized construction methods and in addition including standardization and prefabrication, global trends in construction technology and project delivery practices.

BUQS1999A  Vacation Work II (Building)
Qualifying course for BSc(CM) and BSc(CMS)
Vacation work to be completed during a period of six consecutive weeks during the third year of study. Where possible the vacation work should take place on constructional work or in a planning office concerned with such works, and should be according to the departmental guidelines for vacation work. 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.

BUQS1994A  Practical Experience III
Qualifying course for BSc(CS)
The aim of this course is to provide learners with practical experience and exposure to construction processes, technologies, materials, management, ethical issues and construction health and safety.

BUQS4022  Simulated Project
Qualifying course for BSc(Hons) QS
Students 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.

BUQS4023  Dispute Resolution
Qualifying course for BSc (Hons) QS
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.

BUQS4024  Cost Evaluation and Control
Qualifying course for BSc (Hons) QS
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.
BUQS4025 Advanced Theory and Practice of Quantity Surveying

Qualifying course for BSc (Hons) QS

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.

BUQS4026 Construction Law

Qualifying course for BSc(Hons) (CM) and BSc(Hons)(QS)

- 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).

BUQS4027 Construction Project Management

Qualifying course for BSc(Hons) (CM) and BSc(Hons)(QS)

- The roles and duties of project management in construction; the life cycle of the project, inception, feasibility, preconstruction, construction and completion. Team building and team coordination. Communication throughout the stages.
- Advanced concepts of Project planning; scope, time and cost, construction planning tools.
- Procurement; Traditional, Design and Build, construction management, Public private partnerships, other innovative procurement systems.
- Quality management, Planning for quality, quality management tools, ISO9000.
- Communication (Communication modules, communication Media in construction).
- Risk Management (process, assessment, identification, analysis and treatment, tools of risk analysis).
- Lean Production concepts; constructability, Just in time, Value Engineering and management, Benchmarking.

BUQS4028 Simulated Project

Qualifying course for BSc(Hons)(CM)

Students are to integrate all the learning in present and previous courses and 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.
BUQS4029  Advanced Construction Management
Qualifying course for BSc(Hons)(CM)
- Work study in construction. Tendering procedures, pretender arrangements, pretender method statements, preparation of pretender programmes, tender analysis, Markup and bidding strategies, Supply chain management and construction logistics.
- The planning process and tools of planning such as the charts and network analysis; Method statements, planning cash flow, Project control procedures (e.g. time and money, and control of the resources). Use of information and communication technologies in construction management.
- Employee’s health, safety and welfare. Employee participation, involvement and empowerment. Workforce diversity and equality in construction. Students are to integrate all the learning in present and previous courses and 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.

BUQS4030  Advanced Building Science
Qualifying course for BSc(Hons)(CM)
- The nature of innovation in the construction industry and its impact on changes in practice in the design and installation of building services
- Concepts and principles applied in lighting systems selection and design in buildings.
- Concepts underlying the design and installation of IT networks in buildings
- the application of Building Information Modelling (BIM) in facilities management and services coordination and installation
- Benefits, risks and challenges associated with BIM for facilities management and services co-ordination and installation.
- Analysis of building components or systems using life cycle costing.
- Current trends in building services design and installation

BUQS4031  Research Report
Qualifying course for BSc(Hons)(CM) and BSc(Hons)(QS)
- Introductory lectures for Introduction to research, problem identification, literature review, research methods, descriptive, analytical, experimental. Writing the report, form and style, referencing, plagiarism, ethics in research, preparation of proposal and research project.
- Students to undertake research with a recommended academic supervisor on an appropriate topic of interest in the Built Environment within the school’s research framework.

BUQS4037  Corporate Real Estate
Qualifying course for BSc(Property Studies)
The aim of this course is to examine 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.

**BUQS4038  Real Estate Development**

Qualifying course for BSc(Property Studies)
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

**BUQS4039  Facilities Management**

Qualifying course for BSc(Property Studies)
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 it enable students serve in
professional roles the 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.

**BUQS4040  Advanced Real Estate Market Analysis**

Qualifying course for BSc(Property Studies)
• The overall aim of this course is to provide students with good working knowledge of:
  • How real estate markets function at the macroeconomic/metropolitan level and at the
    more narrow/microeconomic/site level
  • How to go about analyzing in a meaningful way different real estate markets for
development, investment and/or valuation purposes.
After the course, participants should be able to (individually and in groups):
  • Describe the market analysis process and explain the reasons for it
  • Explain the different theories of urban growth and use them to analyze the relocation
choice of a hypothetical company
  • Analyze the growth of a given metro and offer advice on which asset classes are likely to
be affected by metro growth
  • Estimate demand and supply gaps for different asset classes
  • Use micro-level analysis of the different asset classes to forecast prices, rents and
absorption
  • Use market analysis for different property types to give investment advice
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.

**BUQS4041  Research Report**

Qualifying course for BSc(PS)
• Introductory lectures for Introduction to research, problem identification, literature
review, research methods, descriptive, analytical, experimental. Writing the report,
form and style, referencing, plagiarism, ethics in research, preparation of proposal
and research project.
• Students to undertake research with a recommended academic supervisor on an appropriate topic of interest in the Built Environment within the school’s research framework.

**BUQS1990**  
**Practical Training**

Qualifying course for BSc(Hons)(CM)

Students source experiential training in a construction management 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. They may be given specific assignments by the company. The students submit a journal and a report on their experience within two weeks of completion of practical training. The journal must be seen by the work mentor.

**BUQS1991**  
**Practical Training**

Qualifying course for BSc(Hons)(QS)

Students 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. They may be given specific assignments by the company. The students submit a journal a report on their experience within two weeks of completion of practical training. The journal must be signed by the work mentor.

**Postgraduate courses**

*(All courses 20 credit points unless otherwise indicated)*

**BUQS5013A**  
**Real Estate Law (12 points)**

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, and legal descriptions. Default and the process of foreclosure will be covered.

**BUQS5014A**  
**Real Estate Market Analysis (12 Points)**

The link between macroeconomic variables and the real estate sector; Defining market area; Productivity analysis; Estimating real estate demand; Estimating supply/GAP; Absorption.

**BUQS5015A**  
**Real Estate Valuation (18 points)**


**BUQS5016A**  
**Quantitative Methods for Property Studies (18 points)**

The course is intended to help students 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.
BUQS5017A  Commercial Real Estate Investments (18 points)

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.

BUQS5018A  Applied Macroeconomics (18 points)

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.

BUQS5019A  Real Estate Finance (12 points)

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.

BUQS5020A  Real Estate Development (12 points)

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.

BUQS5021A  Law for Property Development and Management I (10 points)

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.

BUQS5022A  Law for Property Development and Management II (10 points)

The purpose of this course is to equip learners with in depth knowledge of the legal and legislative framework that impacts upon the property environment. Learners 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. Learners will learn about the various ownership vehicles that can be used to own property. Learners will also learn about the legal principles relating to corporate governance.

BUQS5023A  Real Estate Market Analysis (10 Points)

The link between macroeconomic variables and the real estate sector; Defining market area; Productivity analysis; Estimating real estate demand; Estimating supply/GAP; Absorption.

BUQS5024A  Real Estate Valuation (10 points)

This unit 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:

Residential Real Estate Valuation Theory and Application - market data collection and analysis: variable selection and comparable identification; Factor analysis and valuation reporting.

Commercial Real Estate Valuation: 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;

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.

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.


International valuation standards, Statutory valuations including municipal mass valuations and valuations for expropriation purposes, Valuation of servitudes, and agricultural property valuations.

**BUQS5025A  Quantitative Methods for Property Studies**

The course is intended to help students 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.

**BUQS5026A  Commercial Real Estate Investments**

*(10 points)*

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.

**BUQS5027A  Applied Macroeconomics (10 points)**

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.

**BUQS5028A  Real Estate Finance (10 points)**

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.
BUQS5029A  Real Estate Development (10 points)
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.

BUQS5030A  Real Estate Brokerage (10 points)
The purpose of Real Estate Brokerage is to provide participants with working knowledge of real estate brokerage. After the course, participants should be able to:
- Describe the brokerage function and explain the reasons sellers use brokers
- Explain the real estate licensing process in the South African context
- Differentiate between licensing and certification in the South African context
- Explain how commission rates are determined
- List, describe and analyse listing contracts
- Describe and analyse agency relationships in real estate brokerage and the impact of asymmetric information on the agency relationship
- Explain the protective provisions for a property owner and broker that should be included in a listing contract
- Explain the ways that a listing contract can be terminated
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

BUQS5031A  Real Estate Development (10 points)
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.

BUQS5032A  Management and Leadership for the Property Sector
The goal of the course is to formalise the development of leadership skills of participants in preparation to entering the property sector. The course covers the following areas:
Managerial Roles and Competencies.
Self-Awareness: Emotional Foundations of Personal Growth
Self-Awareness: Developing Self Awareness
Self-Awareness: Tools for Reflection
Self-Awareness: Stress Management
Problem-Solving Skills for Managers
Communication Skills
Managerial Power and Influence
Motivation Techniques and Performance Improvement I
Motivation Techniques and Performance Improvement II
Managing Conflict
Empowering and Delegating
Working in and Leading Effective Teams

BUQS5033A  Introduction to Facilities Management
The course primarily provides an introduction to the concept of facilities management. The role of the facilities manager in a corporate organization; 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

**BUQS5034A  Building Services**

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 students.

**BUQS5035A  Strategic Planning**

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

**BUQS5036A  Commercial/Procurement Law**

The course primarily focuses on laws on employees and contract law as well as property law

**BUQS5037A  Space and Workplace Management**

The course outlines the key issues related to managing the spatial resource of organizations. This includes operational issues such as: the development of space standards, relocation management and space planning.

**BUQS5038A  Information Technology in Facilities Management**

The course covers primarily Mobile growth, fixed network need, Bluetooth, WIMAX, voice becomes data, WiFi 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 softwares such as Computer Aided Facilities Management, Building Information Modelling, Computer Maintenance Management Software, Estates master and so on
BUQS5039A  Project Management
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.

BUQS5040A  Environmental Management
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.

BUQS5041A  Occupational Health and Safety
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.

BUQS5042A  Advanced Facilities Management
This module will cover issues on laws on employees and contract law as well as property law

BUQS7009A  Research Methodology
Philosophy of research, Research designs and Proposals, Data generation Ethics, Report Writing Descriptive Statistics, Statistical inference, Using statistical packages.

BUQS7022A  Construction Law and Contract Management
The course is intended to equip the student with an understanding of the legal and organizational 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.
BUQS7024A  Project Management
This course will examine 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.

BUQS7025A  Construction Planning and Control
Project planning and control: Introduction to planning and control techniques and its importance to the successful project delivery. CPM, PDM, Resource Loading and Resource Allocation, Time-Cost Trade-off, Earned-Value Analysis and Project Quality Management. Computer application tools in project planning and control (Primavera or MS Project).
Procurement management: Introduction to various procurement methods, Partnering and Alliancing, Corporate Teaming Arrangements, Transaction Cost analysis and Procurement Risks.
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.

BUQS7026A  Construction Economics and Finance
Basic concepts of economic analysis, feasibility studies and evaluation of alternative engineering projects for capital investment.
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).
Value and Client Management techniques.

BUQS7028A  Real Estate Finance (10 points)
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.

BUQS7029A  Real Estate Development (10 points)
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.

BUQS7030A  Real Estate Market Analysis (10 points)
The goal of the course is to introduce participants 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

**BUQS7031A  Real Estate Law (10 points)**

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.

**BUQS7032A  Property Valuation (10 points)**

This unit 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 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: Commercial Property Valuation, Spreadsheet modelling and Argus Valuation DCF ® Software
- **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
- **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**

**BUQS7033A  Applied Macroeconomics (10 points)**

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.

**BUQS7034A  Advanced Topics in Real Estate Studies (10 points)**

This course aims to help students start 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 student’s own choice.

The course has two parts: one part focuses on deepening the skills in reading, analysing scientific papers as well as writing that will be taught during the disciplinary courses. The second part deals with research issues in real estate studies. Part I consists of: The Research process; Literature search; Critical analysis of source material; Topic selection; Writing in the context of research; Problem formulation; Avoiding plagiarism

Part II consists of seminars on research topics. Parts 1 and 2 will run almost simultaneously.

**BUQS7035A Commercial Real Estate Investments**

*(10 points)*

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.

**BUQS7036A Quantitative Methods for Property Studies**

The course is intended to help students 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.

**BUQS7037A Construction Safety and Quality Management**

The purpose of this course is to gain knowledge and understanding on various theories and practices around the construction safety and quality management.


SCHOOL OF ECONOMIC AND BUSINESS SCIENCES

ECON1002A Economic Concepts IA

Qualifying course for BSc(URP)

(Note: Credit cannot be obtained for Economic Concepts IA and B and Economics I)

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.

ECON1003A Economic Concepts IB

Qualifying course for BSc(URP)

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.

ECON1007A Introduction to Environmental Economics

(9) (2-1-0) (1 term)


ECON1012A Economics IA - Microeconomics

Qualifying course for BSc (Construction Studies) and BSc (Property Studies)

First year microeconomics introduces students to the core microeconomic theory. The course investigates the optimizing 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. Students who wish to proceed to any second year economics courses after completing this course need to achieve a minimum pass mark of 65%.

ECON1014A Economics IB - Macroeconomics

Qualifying course for BSc (Construction Studies) and BSc (Property Studies)

First year macroeconomics introduces students to the 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 (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: measuring output, unemployment, and inflation; the business cycle; the aggregate expenditure, aggregate demand and aggregate supply; and ISLM models; fiscal policy; money policy, banks and interest rates determination; the balance of payments; and applied economic growth analysis. Students who wish to proceed to any second year economics courses after completing this course need to achieve a minimum pass mark of 65%.

SCHOOL OF ELECTRICAL AND INFORMATION ENGINEERING

ELEN1000A Electric Circuits

(15) (2-0-0.5) (2 terms)

Modelling of electric circuits

**Basic electrical concepts:** Voltage, current, energy power, resistance, independent and dependent ideal voltage and current sources, charge, average value.

**Waveforms:** dc, step, ramp, rectangular pulse, sinusoidal, exponential.

**Energy and power:** Instantaneous power, average power, general power equation, energy-power relations, conservation of energy, ideal voltage and current sources, root mean square values.

**Network theorems and laws:** Ohm’s law, Kirchhoff’s voltage and current laws, series and parallel resistors, voltage and current divider laws, star-delta transformations, interconnected sources.

**Systematic circuit analysis:** Node voltage and mesh current analysis, super-position theorem.

**Electrical measurements:** Oscilloscope and digital multimeter functional descriptions and applications.

**Two terminal networks:** Real sources, source transformations, Thévenin and Norton theorems, maximum power transfer in resistive circuit.

Inductors and capacitors: Physical basis of their voltage current laws, v-i laws in integral and differential forms, energy and power relations, behaviour under excitation, capacitive voltage divider.

**Operational amplifiers:** Abstraction to circuit model, open loop gain, input resistance and output resistance. Exact and virtual earth analyses of inverting, non-inverting, buffer, summing integrator and differentiator types. Calculation of gain and input and output resistance. These topics are examined under Knowledge Areas as described in the CB&O.

**Corequisites:** MATH1014A, PHYS1014A

ELEN1003A Critical Thinking

(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.

ELEN1004A Engineering Skills and Design

(12) (0.5-1-0) (2 terms)

This course will consist of a design project and tasks and will have the following outcomes:

- Basic computer literacy;
- Introducing students to solving engineering design/problems in a structured, methodical way;
- Demonstration of oral and written communication skills;
- Representing ideas using engineering graphics;
- Working as a member of a team;
- Awareness of professional, ethical, environmental and social issues in engineering.

**ELEN1005A Electric Circuits (Part Time)**

(15) (2-0-0.5) (2 terms)

Modelling of electric circuits

**Basic electrical concepts:** Voltage, current, energy power, resistance, independent and dependent ideal voltage and current sources, charge, average value.

**Waveforms:** dc, step, ramp, rectangular pulse, sinusoidal, exponential.

**Energy and power:** Instantaneous power, average power, general power equation, energy-power relations, conservation of energy, ideal voltage and current sources, root mean square values.

**Network theorems and laws:** Ohm’s law, Kirchoff’s voltage and current laws, series and parallel resistors, voltage and current divider laws, star-delta transformations, interconnected sources.

**Systematic circuit analysis:** Node voltage and mesh current analysis, super-position theorem.

**Electrical measurements:** Oscilloscope and digital multimeter functional descriptions and applications.

**Two terminal networks:** Real sources, source transformations, Thevenin and Norton theorems, maximum power transfer in resistive circuit.

Inductors and capacitors: Physical basis of their voltage current laws, v-i laws in integral and differential forms, energy and power relations, behaviour under excitation, capacitive voltage divider.

**Operational amplifiers:** Abstraction to circuit model, open loop gain, input resistance and output resistance. Exact and virtual earth analyses of inverting, non-inverting, buffer, summing integrator and differentiator types. Calculation of gain and input and output resistance. These topics are examined under Knowledge Areas as described in the CB&O.

Corequisites: MATH1014A, PHYS1014A

**ELEN1997A Vacation Design Project**

The vacation design project will consist of independent work performed during vacation time on an assigned engineering design project. The assessment will be based on evaluation of the functionality of the construction and a research report.

**ELEN2000A Electrical Engineering**

(18) (4-1-1) (1 term)


**Semiconductor Devices:** Diodes, Transistors, Silicon Controlled Rectifiers.

**Analog Electronics:** Power Supplies, Operational Amplifiers, Filters, Strain Gauge Circuits.

**Digital Electronics:** Logic Gates, Arithmetic Circuits.

**Power Circuits:** Power Factor. Electricity Tariffs. Three Phase Circuits. Transformers – equivalent circuit.

**Electric Motors:** DC motors – equivalent circuit, series and shunt connection, separately excited, torque-speed curves, starting. Induction Motors – equivalent circuit,
torque-speed curves, starting.

Prerequisites: MATH1014A, PHYS1014A or CHMT1001A or PHYS1025A or PHYS1000A

Corequisite: MATH2011A or MATH2012A

ELEN2001A  
Electronics I

(18) (4-1-1) (1 term)

Diodes: Silicon Diode: Reverse Breakdown and small signal models. Rectifier circuits. Other diode types.


Field Effect Transistors: Enhancement MOSFET’s: Biasing, amplification and switching.


Logic: Basic gates. Combinational Logic. Sequential Logic. Logic reduction techniques. These topics are examined under Knowledge Areas as described in the CB&O.

Applications: Regulated dc power supplies, wave shaping circuits, bipolar junction transistor switch, non-linear and linear op-amp amplifier based circuits, basic combinational and sequential logic circuits

Prerequisites: ELEN1000A, ELEN1001A or ELEN1004A, MATH1014A, PHYS1014A

ELEN2003A  
Electric and Magnetic Systems

(18) (4-1-0.5) (1 term)


The electric field: Charge, field strength and potential. Capacitance in a variety of geometries. Charge accumulation, including “static electricity”. Coupling models. Elementary transducers.


Electromechanical energy conversion: The general theory of electromechanical energy conversion. The application of the theory to a variety system. Dynamics of elementary transducers.

Elementary power systems: Three phase ac systems. Power rectification. The components in a modern power system. Tariff philosophies and power factor correction.

These topics are examined under Knowledge Areas as described in the CB&O.

Prerequisites: MATH1014A, PHYS1014A, ELEN1000A

ELEN2004A  
Software Development I (Full Time)

(18) (4-1-1) (1 term)

Introduction to Computing


Prerequisites: MATH1014A, PHYS1014A, ELEN1000A
**ELEN2005A  Signals and Systems I**

(12) (2-1-0.5) (1 term)

**Systems, Signals and Time-Domain Techniques:** Signals, transformation of the independent variable, singularity functions (impulse and step function), systems, LTI system properties, convolution, representation of a system in terms of differential equations, time domain system responses, introduction to MATLAB.

**Laplace Transform and s-domain techniques:** The Laplace Transform and Inverse Laplace Transform, convergence of the Laplace Transform, applications and properties of the Laplace Transform, Laplace Transforms of simple signals, poles and zeros, inverting the Laplace Transform (partial fraction expansion and residues), convolution, initial value and final value theorems, solution of LTI differential equations (DEs), zero-input and zero-state responses, system stability, system inter-connections, relationship between frequency response and Laplace Transform, Solution of LTI DEs using the Laplace Transform.

Resonance, Network synthesis, System analysis using Two-Port Network concepts.

Maximum Power Transfer.

Fourier Series

These topics are examined under Knowledge Areas as described in the CB&O.

**Prerequisites:** ELEN1000A, MATH1014A

**ELEN2006A  Microprocessors**

(15) (3-1-1) (1 term)

**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.

**Prerequisites:** MATH1014A

**Corequisites:** ELEN2001A, ELEN2004A or COMS1015A, COMS1018A

**ELEN2009A  Software Development I (Part Time)**

(18) (4-1-1) (1 term)

Introduction to Computing


**Prerequisites:** MATH1014A, PHYS1014A, ELEN1000A

**ELEN1998A  Vacation Work I (Electrical)**

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.

**ELEN3000A  Electromagnetic Engineering**

(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, usbusqse, 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.

*Prerequisite:* MATH2014A

*Corequisite:* MATH3025A

**ELEN3002A  Electronics II**

(15) (3-1-1) (1 term)

Basics of modelling electronic components.

Modeling of passive components.

Circuit design and analysis.

Dealing with complexity.

*Prerequisites:* MATH2014A, ELEN2005A, ELEN2001A

**ELEN3003A  Power Engineering**

(15) (3-1-2) (1 term)

**Three Phase Transformers:** Three Phase Transformer connections. Phase shift. Equivalent circuit. Per unit notation and transformers in parallel


**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.

**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.

*Prerequisites:* MATH2014A, ELEN2003A

**ELEN3007A  Probabilistic System and Signal Analysis**

(12) (3-1-0) (1 term)

Fundamental concepts of probability.

Elementary set theory and probability.

Random variables and probability distributions.

Some important random variables and their distribution functions.

Operations on a random variable.

Vector random variables.
Random or Stochastic processes.
Stochastic processes and their spectral characteristics.
Linear systems with random inputs.
Prerequisite: MATH2014A
Corequisite: MATH3025A or APPM3021A

**ELEN3008A Biomedical Measurement, Instrumentation and Imaging**

(12) (3-0-0) (1 term)

Measurement systems and instrumentation, with specific examples drawn from medical applications. The course will also cover aspects of medical imaging, including the physics of medical image formation and the basics of image processing.

There are two Knowledge Areas in this course:

- Practical proficiency
- Theoretical proficiency

These Knowledge Areas will be examined as described in the CB&O.

Prerequisites: ELEN2005A, ELEN2001A

**ELEN3009A Software Development II**

(18) (3-0-3) (1 term)


Object construction, destruction, assignment and composition.

Inheritance and polymorphism. Error handling and exceptions. Unified Modelling Language (UML) and automated documentation tools. GUI development using a game programming library. Iterative and incremental delivery. Unit testing using a unit testing framework. Design patterns.

Prerequisites: ELEN2004A, ELEN2006A

**ELEN3012A Signals and Systems II A**

(12) (3-1-0) (1 term)

Fourier transforms; applications of the Fourier transforms; Bode plots; continuous filter design; State variable modelling; solution of the State equations in time and frequency domains; sampling continuous time signals.

Prerequisite: ELEN2005A, MATH2014A

**ELEN3013A Signals and Systems II B**

(9) (2-1-0) (1 term)

Discrete time signals and LTI systems. Discrete Fourier transform and the FFT; Z transform; discrete IIR and FIR filters; discrete state space modelling.

Prerequisite: MATH2014A, ELEN2004A, ELEN2005A

Corequisite: ELEN3012A

**ELEN3014A Biomedical Signals, Systems and Control**

(9) (2-0-0) (1 term)

Discrete time signals. Discrete Fourier transform and the FFT; system principles; modelling; linearisation of non-linear systems; introductory control concepts; application of modelling and control to various biological, physical and economic systems.


**ELEN3015A  Data and Information Management**

(18) (3-1-3) (1 term)

**Security:** Cryptography, cryptology and cryptanalysis, encryption, measures of effectiveness of encryption algorithms, symmetric and asymmetric (public key) algorithms, standards, block ciphers and stream ciphers, public key algorithms, authentication, integrity and non-repudiation, key handling, multiple public key cryptography, secret sharing, SET (secure electronic transactions), e-commerce, cryptographic hardware/software requirements and tradeoffs.

**Compression:** Entropy of information, source modelling, origins of redundancy, compressibility and compression to remove redundant information, lossless and lossy compression, statistical methods and dictionary-based methods, examples of lossless compression algorithms – lossless video and audio compression, lossy compression algorithms for different source types (telecomms and multimedia), sensitivity of compressed information to errors – methods of dealing with this problem, effect of compressed information on network traffic patterns.

**Information integrity:** Integrity checking – parity checks, checksums, LRC, CRC, Error correction; FEC, Hamming distances and codes, Reed-Solomon coding, matching the coding scheme to the channel error characteristics, line codes, HDLC principles.

*Prerequisites:* ELEN2004A, ELEN2005A

*Corequisites:* APPM3021A

**ELEN3016A  Control I**

(18) (3-2-1) (1 term)

**Introduction to control systems:** System and Control concepts. Physical system representations using block diagrams and transfer functions.

**System modelling and analysis:** Physical system modelling. State-space modelling. Low order transfer function prototypes.

**Control system design principles:** Closed loop specifications for one and two degree-of-freedom feedback systems. Use of frequency domain control design tools such as Bode, Nyquist plots and Nichols Charts.

**Stability analysis:** such as root locus, Routh Hurwitz test and Nyquist criterion.

*Prerequisites:* MATH2014A, ELEN2005A

*Corequisites:* ELEN3012A, ELEN3013A

**ELEN3017A  Electrical Engineering Design**

(15) (2-0-0) (1 term)

The project comprises an in-depth engineering design, initially conducted on paper, and followed by its practical development.

*Prerequisites:* All second-year courses

*Corequisites:* ELEN3002A, ELEN3012A, ELEN3013A, ELEN3016A, ELEN3009A, ELEN3007A

*Corequisites:* dependent on option chosen: ELEN3000A, ELEN3003A or ELEN3024A, ELEN3015A
ELEN3018A  Economics of Design

(12) (2-0-0) (1 term)
Principles of macro and micro economics, engineering cost accounting, financial accounts, income statements, balance sheets, ratio analysis, development of business plans, macro economic analysis.
Prerequisites: ELEN2001A, ELEN2004A

ELEN3020A  Professional Practice and Software Development

Many Applies Computing graduates will be required to develop systems which have a significant and often complex software component. These systems are found in engineering sectors, such as telecommunications, hardware design, power generation and distribution, as well as in others, such as the financial, pharmaceutical, and security sectors. The student will be exposed to issues surrounding professional practice, ethics, society and the environment, legal and financial matters, health and safety. The student will also develop the ability to design and implement a solution to a software problem within a multi-person team using established best practices.

ELEN3024A  Communication Fundamentals

(12) (3-1-0.5) (1 term)
Communication modes: simplex, half-duplex, full-duplex;
The A/D and D/A process: PCM, Nyquist criteria, quantization noise;
Impacts of noise on the communication channel: Shannon-Hartley theorem, types of noise, crosstalk;
Analog modulation: AM and Angle modulation (FM and PM), modulation and demodulation, bandwidth, noise performance;
Digital modulation: PSK, QPSK, M-FSK, M-QAM, OFDM, modulation and demodulation, bandwidth, noise performance (BER, SNR), information rate (bits/symbol), constellations, eye patterns;
Multi-user techniques: TDM, FDM, Frequency hopping, CDMA;
Basic antenna theory: point source, different antennas, link budget; Propagation; Equalization.
Prerequisite: ELEN2005A
Corequisites: ELEN3007A, ELEN3012A

ELEN1999A  Vacation Work II (Electrical)

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.
ELEN4000A  **Electrical Engineering Design II**

(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.

*Prerequisites:* ELEN3000A, ELEN3002A, ELEN3003A, ELEN3007A, ELEN3009A, ELEN3012A, ELEN3013A, ELEN3016A, ELEN3017A, ELEN3018A, MATH3025A

ELEN4001A  **High Frequency Techniques**

(15) (2-1-1) (1 term)


Array Theory: Isotropic arrays, Pattern Multiplication, Binomial Arrays, Uniform Arrays, Interferometer, Multi-beam “Smart Antennas”, Continuous Aperture distributions.

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).

*Prerequisites:* ELEN3000A, MATH3025A

ELEN4002A  **Electrical Engineering Laboratory**

(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.

*Prerequisites:* ELEN3000A, ELEN3002A, ELEN3003A, ELEN3007A, ELEN3009A, ELEN3012A, ELEN3013A, ELEN3016A, ELEN3017A, ELEN3018A, MATH3025A

ELEN4003A  **High Voltage Engineering**

(15) (2-1-1) (1 term)

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.

*Prerequisites:* ELEN3000A, ELEN3003A

ELEN4006A  **Measurement Systems**

(15) (2-1-1) (1 term)


*Prerequisites:* ELEN3002A, ELEN3007A, ELEN3012A,
**ELEN4009A  Software Engineering**

*(15) (2-1-1) (1 term)*

What is Software Engineering and why is it needed? Managing the software development process; the software lifecycle; configuration management; people management and team organisation; software quality; cost estimation; project planning and control. The software development process; requirements engineering; software architecture; software design; software testing; software maintenance. Software reusability. Software reliability. Software performance.

*Prerequisites:* ELEN3009A

**ELEN4010A  Software Development III**

*(15) (2-1-1) (1 term)*

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.

*Prerequisites:* ELEN3009A

**ELEN4011A  Information Engineering Design**

*(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.

*Prerequisites:* ELEN3002A, ELEN3007A, ELEN3009A, ELEN3012A, ELEN3013A, ELEN3015A, ELEN3016A, ELEN3017A, ELEN3018A, ELEN3024A, APPM3021A

**ELEN4012A  Information Engineering Laboratory**

*(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.

*Prerequisites:* ELEN3002A, ELEN3007A, ELEN3009A, ELEN3012A, ELEN3013A, ELEN3015A, ELEN3016A, ELEN3017A, ELEN3018A, ELEN3024A, APPM3021A

**ELEN4014A  Electromechanical Conversion**

*(15) (2-1-1) (1 term)*

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.

*Prerequisites:* ELEN3003

**ELEN4016A  Control II**

*(15) (2-1-1) (1 term)*

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.

Prerequisites: ELEN3012A, ELEN3013A, ELEN3016A

ELEN4017A  Network Fundamentals

(15) (2-1-1) (1 term)
This course will explore the concepts, principles and architecture of communication networks, making reference to appropriate examples from the Internet and public telephony networks (PSTN).
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.

Prerequisites: ELEN3024A

ELEN4018A  Power Systems

(15) (2-1-1) (1 term)
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.

Prerequisites: ELEN3000A, ELEN3003A

ELEN4019A  Selected Topics in Sociology

(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.
The learning outcomes are:
• Gaining insight into our social, political and economic environment through multidisciplinary approaches while being firmly anchored within the discipline of sociology
• Enabling a critical understanding of society from a global and South African/African perspective
• Practicing and acquiring methods of critical thinking and writing

ELEN4020A  Data Intensive Computing in Data Science

Parallel computing platforms and programming models
Shared-memory and concurrent programming with PThreads/Cilkplusplus/OpenMP
Introduction to Message Passing Interface (MPI)
Large-scale data management techniques in distributed parallel computing
In-memory data management techniques - BerkeleyDB, LevelDB
Parallel File Systems and Parallel Database - BeeGFS, SciDB
MapReduce computing framework: Hadoop in cluster computing & Hadoop in cloud computing
Data intensive computing applications over HDF5 and parallel-HDF5
Selected topics from
i.) Big-data warehousing and business intelligence
ii.) Spatial and Spatio-Temporal applications
iii.) Health demographic and surveillance systems
iv.) Meta-data services, data discovery and data provenance
Corequisites: ELEN3009A

Postgraduate courses

(All courses 20 credit points unless otherwise indicated)

Check with the School to find out which courses are on offer each year.

ELEN5000A Measurement Systems

Revision of applicable material from electronics, probabilistic signals and systems.

ELEN5001A High Frequency Techniques

Revision of Electromagnetic Engineering fundamentals and principles- Maxwell’s equations and applicable mathematical techniques.
Array Theory: Isotropic arrays, Pattern Multiplication, Binomial Arrays, Uniform Arrays, Interferometer, Multi-beam “Smart Antennas”, Continuous Aperture distributions.
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).

ELEN5002A High Voltage Engineering

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

ELEN5003A Software Engineering

Revision of applicable material from software development. What is Software Engineering and why is it needed? Managing the software development process; the software lifecycle; configuration management; people management and team organisation; software quality; cost estimation; project planning and control. The software development process; requirements engineering; software architecture; software design;

**ELEN5004A Software Development III**

This course is part of the postgraduate diploma in electrical engineering. It is modelled on an existing fourth year course. The credits for this course are greater than the existing course and additional foundational material is included to enable a non-mainstream electrical engineer to engage with the content. Additionally there is a larger scoped project which adds to the credits.

**ELEN5005A Electromechanical Conversion**

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.

**ELEN5006A Network Fundamentals**

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.

**ELEN5007A Control II**

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.

**ELEN5008A Power systems**

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.

**ELEN7007A Electrical Discharges in Gases**

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 behavior of gas-solid interfaces is also examined in a similar fashion.
ELEN7009A Principles of Insulation Coordination in Electrical Power Systems

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.

ELEN7010A Selected Topics

There is no syllabus for this course – the topic varies from year to year.

ELEN7011A Selected Topics in Communication

There is no syllabus for this course – the topic varies from year to year.

ELEN7012A Selected Topics in Software Engineering

There is no syllabus for this course – the topic varies from year to year.

ELEN7013A Selected Topics in Power Engineering

There is no syllabus for this course – the topic varies from year to year.

ELEN7015A Teletraffic Engineering

Review of essential probability theory: negative exponential, Poisson and Binomial distributions.

Traffic measures: call attempts, holding times, the Erlang.

Analysis of circuit switches: blocking, blocking probability, grade of service, multistage switches and switches with alternative routing.

Queueing systems: queue and server models, applications to packet switching and ATM.

ELEN7016A Intelligent Networks

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.

ELEN7018A Earthing and Lightning Protection


ELEN7020A Non-Linear Modelling, Estimation and Control

The describing function method, Popov and circle criteria, phase-plane methods, Lyapunov methods. Introduction to mathematical theories, including flows and vector fields on a manifold, chaotic dynamics, bifurcation theory, catastrophe theory.

ELEN7021A Optimisation Methods

Performance criteria, functional analysis, Lagrange multipliers, calculus of variations, linear programming, non-linear programming, dynamic programming.

ELEN7022A Artificial Intelligence Methods

ELEN7024A Modelling and System Identification

ELEN7027A Embedded Computer Systems
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.

ELEN7032A Advanced Telecommunications Service Architectures
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.

ELEN7033A Research Methods
Research problem formulation, compiling, organising and critically reviewing literature, dividing problems into subproblems, 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.

ELEN7034A Telecommunications System Design (40 points)
This course consist of an extended project in which a component, system or process required in modern public telecommunications is designed. A comprehensive report conveying the design process, design documentation and describing the product is to be submitted. The candidate is required to demonstrate competencies in both design and technical reporting.

ELEN7035A Telecommunications Investigation Project (40 points)
This course consists of an extended project in which a problem in modern public telecommunications is investigated and recommendations are made on the solution to the problem. A comprehensive report conveying the investigated process and describing the solution is to be submitted. The candidate is required to demonstrate competencies in both design and technical reporting.

ELEN7039A Information Engineering Design (40 points)
This course consists of an extended project in which an information-intensive software system is analysed and designed. A comprehensive report consisting of a description of the analysis and design process, design documentation, test plan and implementation plan is to be submitted. The candidate is required to demonstrate competencies in both design and technical writing.
ELEN7040A Information Engineering Investigation Project (40 points)

This course consists of an extended project in which a problem relevant to the Information and Communication Technology (ICT) Industry is investigated and recommendations are made on the solution to the problem. A comprehensive report conveying the investigation process and describing the solution is to be submitted. The candidate is required to demonstrate competencies in both research and technical reporting.

ELEN7041A Investigational Project in Electrical Power Engineering (40 points)

This is an extended project in which a problem in Electrical Power Engineering is investigated and recommendations are made for its solution. A comprehensive report conveying the investigation and describing the solution is to be submitted. The candidate is required to demonstrate competencies in both research and technical writing.

ELEN7043A Advanced Electromechanical Conversion

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.

ELEN7044A Introduction to Software Engineering

What is Software Engineering (SE)? Introduction to SE Management. The Software Development Lifecycle. Requirements Engineering; Software Design; OO Analysis and Design; Software testing; User Interface Design.

ELEN7045A Software Development Methodologies, Analysis and Design

This course has two major objectives. This first is to set the task of software design within the context of the wider development process. The second objective is to introduce 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.

ELEN7046A Software Technologies and Techniques

The primary objective of this course is to extend 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.

Content: 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.
ELEN7047A  Software Project Management

The course introduces students to key issues in the field of software project management. Topics covered in this course are: Introduction to software engineering concepts and problems: complexity; the software lifecycle; reuse; maintainability. Introduction to Software project management (SPM): problems and objectives; survey of important management approaches; planning; costing. People management and team working. Quality management systems and quality standards. Examples and case studies are given.

ELEN7048A  Variable Speed Drives for AC Machines

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.

ELEN7049A  Telecommunications Access Networks


ELEN7051A  Linear Modelling, Estimation and Advanced Linear Control

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.

ELEN7052A  Selected Topic – Systems and Control

There is no syllabus for this course – the topic varies from year to year.

ELEN7053A  Power Engineering Design (40 points)

This course consists of an extended project in which a power system is analysed and designed. A comprehensive report consisting of a description of the analysis and design process, design documentation, test plan and implementation plan is to be submitted. The candidate is required to demonstrate competencies in both design and technical writing.

ELEN7054A  Investigational Project in Systems and Control (40 points)

This is an extended project, in which a problem in Systems and Control Engineering is investigated and recommendations are made on its solutions. A comprehensive report is to be submitted, describing the investigational process and the solutions. The candidate is required to show competency in both research and technical writing.

ELEN7055A  Database Systems

Large information models are an important component in many modern engineering applications. The course covers the principles underlying information modeling 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.

**ELEN7056A  Power Electronics**

This course introduces students 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.

**ELEN7057A  Advanced Power Systems Analysis**

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.

**ELEN7059A  Principles of Communication Systems**

This course covers the basics of digital and analogue information transfer over wired and wireless links. Topics include baseband and bandpass (M-FSK, M-PSK, M-QAM) modulation formats and associated pulse shaping, symbol timing and carrier recovery techniques, together with bandpass 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.

**ELEN7060A  Introduction to Packet Networks**

This module 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 provides coverage of addressing and routing within a local area network (LAN).
**ELEN7061A  Telecommunications Business Environment**

This module deals with 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.

**ELEN7062A  Coding Techniques for Telecommunications**

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 utilized 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.

**ELEN7063A  Network Planning, Performance and Services Management**

The module 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.

**ELEN7064A  Principles of Wireless Communications**

The main focus of this course is on the design, analysis, and fundamental limits of wireless transmission systems. In particular, we look at the wireless channel and system models, fading and diversity, resource management and power control, multiple-antenna and MIMO systems, space-time codes and decoding algorithms, multiple-access techniques and multiuser detection, cellular and ad-hoc network topologies, OFDM and ultrawideband systems, and architectural issue.

**ELEN7065A  Telecoms Network Architectures**

This module introduces fundamental principles in the design and operation of modern telecommunication networks, with specific focus on the core network. Topics included are control signalling (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.
ELEN7066A Global Trends and Sustainability of Energy Generation

- Global overview of power generation and the history of power generation
- Alternate sources of power generation
- Regional competitive advantage of specific methods of power generation
- Models for sustainable power generation using alternate sources
- 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

ELEN7067A Research Methodology

Research is considered to be the process of making new knowledge. This process will be approached from the point of view of what constitutes knowledge in different domains and what is a good research question. When is new knowledge a contribution to existing knowledge and how can we be certain it is a contribution. New knowledge can only be accepted within the context of existing knowledge and the construction of a sound foundation is of the utmost importance. The research tools of creative problem solving, argument and planning will be discussed in detail. The course will lead to the development of a research proposal.

SCHOOL OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

GEOG1003A Geography for Planners

Qualifying course for BSc(URP)

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 GEOLOGY

GEOL1001A Geology IA

(15) (5-0-3) (1 term)

Minerology: properties and identification of rock forming and economic minerals; petrology; composition and identification of common igneous, sedimentary and metamorphic rocks. Practical work involves the identification of common minerals and rocks.

Internal processes: the nature of the interior of the earth; plate tectonic theory.

Surface processes: rock weathering and soil formation; erosion and denudation; sediment transport and deposition; the rock cycle in the context of plate tectonic theory; introductory geohydrology. Practical work involves geological map interpretation.
GEOL1002A  Geology IB

(15) (5-0-3) (1 term)

Structural geology: brittle and ductile deformation and the formation of folds and faults; solution of structural problems involving folded and fractured rocks.

Economic geology: ore forming processes and the classification of ore deposits; the geology of the world’s major ore deposits.

African geology: the geological evolution of Africa, with particular reference to its ore deposits. Practical work involves the interpretation of geological maps and the solution of structural problems in a mining context.

GEOL3028A  Ore Body Modelling

(15) (5-0-3) (1 term)

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.

SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT

PSYC2019A  Human Resources Psychology II

(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 focuses on the social and psychological processes involved in employee relations from the sociological, political, economic, legal and historical perspectives.

SCHOOL OF LAW

LAWS1000A  Commercial Law I

Qualifying course for BSc(QSS), BSc(CMS), BSc(CS) and BSc(Property Studies)

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.

LAWS2007A  Business Enterprise Law

Qualifying course for BSc(CM), BSc(CMS), BSc(QS), BSc(QSS), BSc(CS) and BSc(Property Studies)

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.
LAW52010A  Mercantile Law

Qualifying course for BSc(CM), BSc(CMS), BSc(QS), BSc(QSS) and BSc(Property Studies)

General principles of employment law, service contracts, the law of cheques, of security (including suretyship, mortgage, pledge and liens), the law of insurance, of insolvency and of property.

SCHOOL OF MATHEMATICS

MATH1014A  Mathematics I

(30) (5-1-0) (2 terms)

Objective: to learn the techniques and simple applications of the algebra of one or more real variables and the calculus of one real variable.

Algebra: (1) Elementary functions and inverse functions. (2) Sigma notation, series, induction. (3) Simultaneous linear equations, simple matrix algebra. (4) Plane curves in polar or parametric form, including conics. (5) Vector methods in three dimensions.

Calculus: (1) Techniques, applications, and interpretation of differentiation and integration. (2) Partial differentiation, simple differential equations.

MATH1038A  Mathematics (CS)

Qualifying course for BSc(CS)

Vectors: Introduction, displacement vectors, unit vectors, multiplication by scalar, equal vectors, addition and subtraction of vectors, position vectors

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

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

Integration and Applications: Anti-derivatives, Indefinite integral, Definite Integral, Area under a curve, integration by parts, volume by integration.

MATH1039A  Mathematics for Property Studies

Qualifying course for BSc(PS)

The course is aimed to provide 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 optimization 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.
MATH1040A  Mathematics I (Part Time)

(30) (5-1-0) (2 terms)

Objective: to learn the techniques and simple applications of the algebra of one or more real variables and the calculus of one real variable.

Algebra: (1) Elementary functions and inverse functions. (2) Sigma notation, series, induction. (3) Simultaneous linear equations, simple matrix algebra. (4) Plane curves in polar or parametric form, including conics. (5) Vector methods in three dimensions.

Calculus: (1) Techniques, applications, and interpretation of differentiation and integration. (2) Partial differentiation, simple differential equations.

MATH2011A  Mathematics II

(27) (4-1-0) (2 terms)

Objective: To learn more advanced techniques and applications of the algebra of real and complex functions and the calculus of several real variables.

Algebra: Complex numbers. Indeterminate forms and series. Linear algebra including eigenvalues and eigenvectors; the Cayley-Hamilton theorem and applications to differential equations; change of coordinates, diagonalisation and applications; orthonormality, unitary and hermitian matrices and quadratic forms. Fourier series.

Calculus: Differential equations. Vector differentiation including curvature, directional derivatives, grad, div and curl, streamlines and potential functions, classification of surfaces. Vector Integration including line integrals, double integrals, Jacobians, Green’s theorem in the plane.

Prerequisite: MATH1014A

MATH2012A  Mathematics II

(15) (4-1-0) (1 term)

Algebra: complex numbers, indeterminate forms, convergence of series.

Calculus: linear differential equations. Vector differentiation including curvature, trajectories and orthogonal trajectories.

Prerequisite: MATH1014A

MATH2014A  Mathematics II

(33) (5-3/2-0) (2 terms)

Objective: To learn more advanced techniques and applications of the algebra of real and complex functions and the calculus of several real variables.

Algebra: Complex numbers. Indeterminate forms and series. Linear algebra including eigenvalues and eigenvectors; the Cayley-Hamilton theorem and applications to differential equations; change of coordinates, diagonalisation and applications; orthonormality, unitary and hermitian matrices and quadratic forms. Fourier series.

Calculus: Differential equations. Vector differentiation including curvature, directional derivatives, grad, div and curl, streamlines and potential functions, classification of surfaces. Vector Integration including line integrals, double integrals, Jacobians, Green’s theorem in the plane.

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.

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.
Prerequisite: MATH1014A

MATH3025A  Mathematical Methods (Electrical)

(15) (4-1-0) (1 term)

Objective: To acquire more advanced techniques for dealing with surface and volume integrals and a sound basis knowledge of complex variable theory including transformations.

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.

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.

Prerequisite: MATH2014A

MATH3026A  Mathematical Methods (Aero and Mech)

(15) (4-1-0) (1 term)

Objective: To acquire more advanced techniques for solving differential equations, dealing with complex transformations and surface and volume integrals.

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.

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.

Prerequisite: MATH2011A

MATH3033A  Mathematical Methods (Industrial)

(7) (2-0-0) (1 term)

Mathematical methods in Industrial Engineering, for example, certain topics from game theory, networks, graph theory, mathematical modelling for simulation, optimisation.

Prerequisite: MATH2011A or MATH2012A or MATH2014A

SCHOOL OF MECHANICAL, INDUSTRIAL AND AERONAUTICAL ENGINEERING

MECN1003A  Engineering Drawing

(27) (2-0-3) (2 terms)

Engineering drawing standards; freehand sketching; orthographic, oblique, isometric and auxiliary projections; fundamental spatial relations and intersections; sectioning; developments; assembly drawings; dimensions and tolerances; perspective drawing; revolutions; application of descriptive geometry; graphical analytical techniques; introduction to Computer Aided Drawing (CAD).
MECN1001A  Introduction to Mechanical Engineering and Design

(18) (4-1-1.5) (1 term)

The Design Process: Design methodology.

Technical systems and process considerations: Product life cycle; material selection; manufacturing methods; detail design, basic engineering modelling; elementary probability and statistics; tolerances; introduction to engineering economics; introduction to structures, mechanisms and machines; technical system functions, characteristics and properties.


Practical laboratory exercises and projects: Aspects of applied engineering; the complementary role of theory and practice.

MECN2000A  Fluid Mechanics I

(12) (3-1-0) (1 term)

Introduction: Properties of fluids: nature, density, viscosity, vapour pressure.
Fluid statics: Pressure distribution, manometric pressure measurement. Fluids in relative equilibrium – constant linear and angular acceleration.
Viscous flow: Laminar and turbulent flow distinction. Laminar velocity profile. Laminar pipe flow, pressure drop and friction factor. Flow between parallel plates, slider bearings.
Fluid dynamics: Continuity equation, Euler equation, Bernoulli equation. Total energy and piezometric lines. Free liquid jets. Flow measurement, pitot-static tube, venturi meter, orifice meter.
Hydraulics: Turbulent pipe flow; minor component losses. Pipe networks.
Forces On Submerged Surfaces: Hydrostatic forces, buoyancy, fluid momentum, impulse, principles of linear and angular momentum. Applications of linear momentum theorem – forces on a pipe bend, Pelton wheel turbine.

Prerequisites: MATH1014A, PHYS1014A
Corequisites: MECN2011A

MECN2005A  Mechanical Engineering Laboratory I

(9) (0.5-0-1) (2 terms)

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.

Prerequisite: PHYS1014A

MECN2006A  Thermodynamics I

(12) (4-0-0) (1 term)

Prerequisites: PHYS1014A, MATH1014A

MECN2010A Introduction to Materials Science and Engineering

(12) (3-1-0) (1 term)

Prerequisites: PHYS1014A, MECN1001A, CHEM1033A

MECN2011A Applied Mechanics A

(15) (4-1-0) (1 term)

Pre-requisites: PHYS1015A, MATH1014A, MECN1003A
Co-requisites: MECN2013A, MECN2014A

MECN2012A Computing Skills and Software Development

(15) (2-0-3) (1 term)
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.

Prerequisites: MATH1014A and MECN1001A

MECN2013A Applied Mechanics B

(15) (3-1-0) (1 term)
Kinematics: Kinematics of particles: rectilinear and plane curvilinear motion, motion relative to translating and rotating axes. Plane kinematics of rigid bodies (simple planar mechanisms).

Pre-requisites: PHYS1015A, MATH1014A, MECN1003A
Co-requisites: MECN2011A, MECN2014A
MECN2014A  Mechanical Engineering Design I

(24) (2-0-3) (2 terms)
Pre-requisites: MECN1001A, MECN1003A, PHYS1015A
Co-requisites: MECN2011A, MECN2013A

MECN2015A  Thermodynamics I (Part Time)

(12) (4-0-0) (1 term)
Prerequisites: PHYS1014A, MATH1014A

MECN2016A Introduction to Materials Science and Engineering (Part Time)

(12) (3-1-0) (1 term)
Prerequisites: PHYS1014A, MECN1001A, CHEM1033A

MECN2017A  Computing Skills and Software Development (Part Time)

(15) (2-0-3) (1 term)
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.
Prerequisites: MATH1014A and MECN1001A

MECN1998A  Vacation Work I (Mechanical)

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.

**MECN3001A Aircraft Structures I**

(9) (3-0-0) (1 term)


*Pre-requisite: MECN2001A or MECN2011A*

*Co-requisites: MECN3005A, MECN3008A*

**MECN3002A Fluid Mechanics II**

(12) (3-1-0) (1 term)

**Boundary Layer Flow:** boundary layer (Prandtl) equations; Von Karman’s momentum integral equation; Thwaites/Walz method for flows with pressure gradients; introduction to turbulent flow in boundary layers.

**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.

**Drag and Lift:** drag and lift coefficients; drag on two-dimensional shapes; drag on three-dimensional shapes; lift and drag on an aerofoil.

*Prerequisite: MECN2000A*

*Corequisite: MATH3026A*

**MECN3003A Aeronautical Engineering Laboratory I**

(15) (0-0-5) (2 terms)

Experimental methods; data acquisition and analysis; safety in the laboratory; report-writing and professional communication; introduction to selected software packages.

Scheduled experimental assignments on selected topics in aeronautical, industrial and mechanical engineering.

Experimental assignments or open-ended projects of an experimental nature, specific to aeronautical engineering.

Corequisites: MECN3001A, MECN3002A, MECN3008A, MECN3010A, MECN3012A, MECN3022A or MECN3027A

MECN3004A  Industrial Engineering Design

(27) (2-0-5) (2 terms)
A realistic approach to engineering design is developed by allowing the student to experience, within a team, whole open-ended interdisciplinary Industrial Engineering design problems, whilst encouraging the development of judgmental skills. The course, of necessity, integrates materials provided by other academic courses and includes: 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 and design communication; work study; ergonomics. Industrial visits: visits to companies involved in manufacturing and related areas of interest.

Complete project reports are prepared which describe devices or systems designed to meet specific needs, including inter alia, fully specified engineering drawings and instructions. One of the projects will be of a service learning nature.

Training in professional communication is an integral part of this course and includes: communication theory; technical report writing; oral presentation; group dynamics; graphic communication.
Corequisite: MECN3014A

MECN3005A  Aircraft Design

(30) (2-0-5) (2 terms)


Industrial visits and lectures: Visits to companies and institutes involved in aeronautics, lectures by experts on manufacturing and practical aspects of aeronautical engineering.

Communication Studies: Training in professional communications is an integral part of this course and includes: Communication theory, technical report writing, oral presentation, team work and decision choice.
Prerequisite: MECN2009A or MECN2014A, MECN2008A or MECN2010
Corequisites: MECN3001A, MECN3008A

MECN3006A  Industrial Engineering Laboratory

(15) (0-0-5) (2 terms)

Experimental methods; data acquisition and analysis; safety in the laboratory; report-writing and professional communication; introduction to selected software packages.
Scheduled experimental assignments on selected topics in aeronautical industrial and mechanical engineering.

Experimental assignments or open-ended projects of an experimental nature, specific to industrial engineering.
Corequisites: MECN3030A, MECN3012A, MECN3014A, MECN3025A
MECN3007A  Mechanical Engineering Laboratory II

(15) (0-0-5) (2 terms)
Experimental methods, data acquisition and analysis; safety in the laboratory; report-writing and professional communication; introduction to selected software packages.
Scheduled experimental assignments on selected topics in aeronautical, industrial and mechanical engineering.
Experimental assignments or open-ended projects of an experimental nature, specific to mechanical engineering.
Corequisites: MECN3002A, MECN3010A, MECN3012A, MECN3017A, MECN3022A or MECN3027A

MECN3008A  Introduction to Aeronautics

(9) (3-0-0) (1 term)
Pre-requisites: MECN2000A, MECN2001A or MECN2011A, MECN2007A or MECN2013A, MATH2011A
Corequisite: MECN3005A, MECN3001A

MECN3010A  Mechanics of Solids I

(15) (4-1-0) (1 term)
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.
Pre-requisites: MECN2001A or MECN2011A
Corequisites: MECN3019A

MECN3012A  Mechatronics I

(15) (3-0-2) (1 term)
Prerequisites: ELEN2000A (students articulating into Industrial Engineering from CIVIL will be required to cover the material in their own time), MECN2003A or MECN2012A or CHMT2011A or CIVN1001A or ELEN2004A or MINN2000A, PHYS1015A or CHMT1001A
Corequisites: MATH3026A or MATH3033A, MECN3005A or MECN3004A or MECN3019A, MECN3003A or MECN3006A or MECN3007A

MECN3013A  Business Management

(12) (3-0-0) (1 term)
This course introduces the engineering student to business. Topics cover economics, financial accounting, budgeting (including marketing), the engineer and the environment.
MECN3014A  Operations Management Techniques

(15) (2-0.5-0) (2 terms)

Introduction to operations management, production planning and control systems, measures of performance (productivity concepts); techniques for process and facilities planning, inventory, forecasting and supply chain management, statistical methods for process control, quality.

Co-requisites: MECN3030A

MECN3017A  Thermodynamics II

(12) (4-0-0) (1 term)


Heat transfer: steady state one-dimensional conduction; introduction to forced and natural convection; black and grey body thermal radiation.

Pre-requisite: MECN2006A

Co-requisite: MECN3007A, MATH3026A

MECN3019A  Mechanical Engineering Design and Production

(30) (2-0-5) (2 terms)

Machine design: mechanical transmissions design (belts, chains, gears, clutches and brakes); shaft design revision (including deformation analysis and critical speed analysis); rolling-contact bearings (selection); journal bearings and lubrication principles (design); plain, non-lubricated and impregnated bearings; cams and springs design; synthesis of machine assemblies.

Manufacturing topics: Introduction to manufacturing, engineering drawing and its manufacturing implications, dimensional and geometric tolerances, engineering materials, heat treatments, engineering metrology, casting and forming processes, powder metallurgy, engineering plastics, sheet metal forming, metal cutting, cutting tools and economics of cutting, conventional and unconventional machining, CNC machining, automation and robotics and company information systems.

Projects and visits: Projects emphasising creativity, machine design practice, sketching and drawing, calculations, communication and report writing. Industrial visits related to projects.

Pre-requisites: MECN2007A or MECN2013A, MECN2009A or MECN2014A, MECN2010A, MECN2001A or MECN2011A

Co-requisite: MECN3010A

MECN3025A  Manufacturing Technology: Processes

(12) (4-0-0) (1 term)

Engineering design relevant to manufacturing processes e.g. 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.

Advanced manufacturing processes e.g. cold gas dynamic spray, pulsed (shock waves) spray process, friction welding.
Corequisites: MECN3006A

**MECN3026A  Principles of Organisational Behaviour**

(9) (3-0-0) (1 term)
Organisational behaviour studies how individuals, groups and systems impact on and are impacted on by their organisations. In this course we will begin to understand issues that impact on international leadership such as values, performance and motivation. We will study why groups often find themselves in conflict and why struggles for power dominate our institutions. We will also analyse how organisations respond with rules, regulations and systems to support particular behaviours to meet end goals. It is through this field of study that we can begin to address this generations most frustrating workplace issues.

**MECN3027A  Mechanical Vibrations**

(15) (4-1-0) (1 term)
Introduction to mechanical vibrations; single degree of freedom systems: free vibration (damped and undamped), harmonic, periodic and impulsive excitation (damped and undamped); vibration isolation; balancing of rotating and reciprocating equipment; two degree of freedom systems: equations of motion, free and forced vibration, natural frequencies and mode shapes, modal analysis and vibration absorption; vibration measurement and applications.

Prerequisite: MECN2007A or MECN2013A or PHYS2001A
Corequisite: MATH3026A

**MECN3028A  Engineering in its Social Context**

(18) (3-0-0) (1 term)
The course exposes students to social issues and teaches them to think critically and argue persuasively so as to develop a vision for a better society. It will enable 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.

**MECN3030A  Operations Research**

(15) (5-0-0) (2 terms)

**Mathematical programming:** Mathematical programming problems, optimisation, linear programming, special structures, post - optimality analysis, networks, integer programming, dynamic programming, non-linear and constraint programming, metaheuristics, neural networks. Operational research.

**Communication and implementation:** theories of implementation, methodology of implementation, strategies for implementation.

Prerequisites:
MATH2011A or MATH2012A or MATH2014A
Corequisite: MATH3033A

**MECN3031A  Mathematical Topics (Industrial)**

(18) (3-0.5-0) (2 terms)
This course is made up of the following modules:

**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).

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, Nonparametric tests, correlation analysis, Linear regression.
Prerequisite: MATH2011A or MATH2012A or MATH2014A
Corequisite: MATH3033A

MECN3032A Numerical Methods and Statistics

(18) (6-1-0) (1 term)
This course is made up of the following modules:
Numerical Methods
Statistics
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.
Prerequisite: MATH2011A

MECN1999A Vacation Work II (Mechanical)
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.
Prerequisite: MECN1998A Vacation work I

MECN1996A Engineering Professional Activity
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.
Prerequisites: All third year courses

MECN4005A Design Project
(39) (8 weeks, full time)
This unit provides the student 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.

Prerequisites: All 3rd year courses in curriculum
Corequisites: All 4th year courses

**MECN4006A Research Project**

(39) (8 weeks, full time)

This course provides the student 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.

Prerequisites: All 3rd year courses in curriculum
Corequisites: All 4th year courses

**MECN4009A Manufacturing Technology: Systems**

(15) (4-0-0) (1 term)

Choice of manufacturing processes: Comparison of metal forming, joining and finishing processes.

Topics in modern manufacturing technology: These may include topics, such as, composite manufacture, rapid product development, etc.

Prerequisite: MECN3015A or MECN3025A

**MECN4013A Thermal Systems**

(15) (4-1-0) (1 term)

Heat transfer: extended surfaces; multidimensional and unsteady conduction, boiling, evaporation and condensation. Heat exchangers.

Thermodynamics: Air standard cycles, Non-reacting gas mixtures and psychrometrics.

Internal combustion engines

Prerequisite: MECN3017A, MECN3021A, MATH3026A, MECN3006A
Corequisite: MECN4021A

**MECN4015A Business Studies**

(12) (3-0-0) (1 term)

Students work in groups to integrate many ECSA outcomes in a major assignment. Groups 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.

Prerequisites: MECN3004A, MECN3013A

**MECN4020A Systems Management and Integration**

(12) (3-0-0) (1 term)

Systems Thinking: Introduction to systems thinking, methodologies and applications.

Project management: Project management methodologies eg PMBOK, Prince II etc. The matrix organisation, project organisation and project functions. General Management
principles. Network scheduling; PERT and CPM; resource allocation etc. Contracts Management: New Engineering Contracts (NEC) etc.

Production and Operations Management: Introduction to manufacturing concepts and factors of production. Inventory control concepts; production management overview – MRP, MRP II, master scheduling and scheduling, ‘JIT’ concepts; overview of quality management, maintenance and reliability, supply chains. Safety and the Environment. Management issues concerning social issues, eg HIV/AIDS in the SA Economy. The focus is on application of these techniques in industry situations.

Corequisites: ME CN4005A or ME CN4006A or E LEN4002A or E LEN4012A

MECN4021A Fluid Dynamics

(15) (4-0-0) (1 term)


Turbulent flows: Fundamental theory, common models and limitations.

Prerequisite: MECN3002A

MECN4023A Mechanics of Solids II

(15) (3-1-0) (1 term)

Mechanics of Composite Materials: Materials; Manufacturing methods; Micromechanics; Macromechanics of a lamina; Failure criteria; Design of composite structures.


Prerequisite: MECN3010A

MECN4024A Gas Dynamics and Propulsion

(15) (4-0-0) (1 term)


Propulsion systems: Basics of jet and non-jet propulsion engines. Thermodynamics and mechanics of propulsion engines and their components.


Prerequisite: MECN3002A
MECN4025A  Aerodynamics

(12) (3-0-0) (1 term)

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.

Prerequisites: MECN3002A, MECN3008A, MATH3026A
Corequisite: MECN4026A

MECN4026A  Flight Dynamics

(12) (3-0-0) (1 term)


Prerequisites: MECN3008A, MECN3022A or MECN3027A
Corequisite: MECN4025A

MECN1004A  Selected Topics in Social Science

(12) (3-0-0) (1 term)

The course introduces engineering students to various aspect 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.

MECN4027A  Aircraft Structures II

(12) (3-0-0) (1 term)


Energy Methods of Structural Analysis: Calculation of loads, deflections, natural frequencies and buckling loads using complementary energy methods and Rayleigh-Ritz technique.


Aeroelasticity: Static phenomena including divergence and control reversal. Lifting and control surface flutter.

Fracture mechanics and its application to damage tolerant aircraft structures.

Prerequisites: MECN3001A, MECN3010A, MECN3022A or MECN3027A

MECN4028A  Decision Support and Intelligence Systems

(15) (4-0-0) (1 term)

Random number theory; probability distributions; queuing and simulation modelling techniques; probabilistic decision making methods. The unit will include an introduction to selected software packages.
Prerequisites: MECN3000A or MECN3030A, MECN3020A or both MECN3029A and MATH3033A

**MECN4029A  Mechatronics II**

(15) (4-0-0) (1 term)

**Background and philosophy of Mechatronics:** System Response and Control

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.

**Pre-requisites** MECN3012A, MATH3026A, MECN3022A or MECN3027A

**MECN4030A  Operations Management: Systems Integration**

(15) (4-0-0) (1 term)

Operations Strategy including aspects of:
- Supply Chain Strategy
- Quality Strategy
- Capacity Strategy
- Technology Strategy
- Statistical Quality Management
- Social and Environmental Issues in Operations Management

**Pre-requisites:** MECN3014A, MECN3020A or MECN3029A

**Postgraduate courses**

*(All courses 20 credit points unless otherwise indicated)*

**MECN5002A  Operations Management**

The course will focus on theory and techniques of operations management and strategy in operations, including capacity strategy, supply network strategy, technology strategy and quality strategy. The course will also cover the principles and techniques of modern statistical quality control, that is, advanced topics such as Design of Experiments and ANOVA will be covered.
MECN5003A  Operations Research Methods

**IT systems analysis and decision making:** random number theory; probability distributions; queuing and simulation modelling techniques; introduction to artificial intelligence; expert systems; metaheuristics; neural networks; data handling. The unit will include an introduction to selected software packages.

**Mathematical programming:** Mathematical programming problems, optimisation, linear programming, special structures, post-optimality analysis, networks, dynamic programming, integer programming.

**Stochastic processes:** probability theory, game theory, decision analysis. Operational research communication and implementation: theories of implementation, methodology of implementation, strategies for implementation

**MECN5004A  Manufacturing Technology Principles**

**Choice of manufacturing processes:** Comparison of metal forming, joining and finishing processes.

**Topics in modern manufacturing technology:** These may include topics, such as, composite manufacture, rapid product development, etc

**Other topics:**

Engineering design relevant to manufacturing processes e.g. 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.

**Advanced manufacturing processes** e.g. cold gas dynamic spray, pulsed (shock waves) spray process, friction welding.

**MECN5005A  Systems Management**

Project management methodologies eg PMBOK, Prince II etc. The matrix organisation, project organisation and project functions, Network scheduling: PERT and CPM; resource allocation, Contracts Management: New Engineering Contracts (NEC) etc.


General Management principles: An introduction

Systems Thinking principles in the context of Production and Operations in different industries, including the interaction between “hard” and “soft” systems.

**MECN5006A  Business Planning Studies**

This course is intended to help the student integrate his/her 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.

**MECN5007A  Engineering Investigation**

The course aims to prepare the student 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
methodology 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.

**MECN5008A  Aerodynamics**

**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.

**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.

**Introduction to turbulence, mixing length theory.**

**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.

**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.

**Linearised two-dimensional compressible flow**, similarity laws, thin aerofoils in supersonic flow.

**Computational aerodynamics:** The panel method and applications.

**MECN5009A  Flight Dynamics and Control**

Aircraft geometry. Performance in steady flight of propeller and jet engined 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 tailplanes; propulsion and other effects; cg limits. Elementary lateral and directional stability.


**Introduction to automatic control including:**

- Basic Control Concepts and Model Types: dynamic system performance; linearisation and its limitations; introduction to the advantages of feedback.

- 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.

- Feedback Control System Characteristics: open- and closed-loop control systems; sensitivity to parameter variations; transient response of controlled systems; disturbance signals in control systems.

- 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.

**MECN5010A  Aircraft Structures**


**MECN5011A  Compressible Flow and Propulsion**


**MECN5012A  Mechanics of Solids**


**MECN5013A  Thermal System**

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.
MECN5014A Fluid Dynamics

Turbulent flows: Fundamental theory, common models and limitations.
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.

MECN5015A Mechatronics

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.
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.

MECN7000A Operational Research Methods

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.
Prerequisite: Suitable background in Mathematics and Statistics

MECN7001A Reliability Engineering

Prerequisite: Basic knowledge of Statistics.

MECN7005A Engineering Economics

Introduction: comparative economic systems; the market economy; demand, supply and equilibrium price; elasticity, measurement, economies of scale and learning curves.
Theories of the firm: Neo-classical economics – price takers and seekers; objectives of organisations; New Institutional Economics

Functions in firms: economic theory for marketing and finance in engineering organisations. Directions for research in Production and Operations management.

**MECN7006A Production and Operations Management**

This course exposes the student 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 student 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 made up by lectures and case studies (these will form an important part of the teaching process).

*Prerequisite:* Students are expected to have read a textbook in Production and/or Operations Management

**MECN7007A Elements of Commercial and Industrial Law**

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.

**MECN7008A Financial Management**

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.

*Prerequisite:* MECN7011A

**MECN7009A Principles of Management**

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.

**MECN7010A Human Resource Management**

Human resources can best be managed as a partnership between line managers and human resource practitioners. This course endeavours to optimise 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.

**MECN7011A Accounting and Financial Statements**


**MECN7013A Principles of Air Conditioning**

Psychrometry and psychrometric processes. Physiological principles: thermal interchanges between man and his/her environment, comfort and health. Cooling and heat load

Prerequisite: Suitable background in Thermodynamics

**MECN7014A Principles of Refrigeration**


Prerequisite: Suitable background in Thermodynamics.

**MECN7016A Quality Management**


Prerequisite: Proof of introductory course in Statistics

**MECN7017A Value Engineering and Analysis**


**MECN7019A Internal Combustion Engine Analysis**


Prerequisite: Suitable background in Thermodynamics

**MECN7020A Manufacturing Strategy**

This course introduces students to the methods and techniques for analysing a manufacturing business from a strategic viewpoint. It integrates key concepts and frameworks encountered in various disciplines. While all the required strategy concepts will be covered in the unit, a basic knowledge of finance is assumed.

**MECN7023A Management of Technology**

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.

**MECN7024A Maintenance Engineering**

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).
MECN7025A Investigational Project (40 points)

The course consists of a project in which a problem or topic in the general fields of Mechanical, Industrial or Aeronautical Engineering is investigated and recommendations are made on the solution to the problem or topic. A comprehensive report covering the investigative process and describing the solution is to be submitted. The candidate is required to demonstrate competencies in investigation, evaluation and technical reporting.

MECN7026A Finite Element Methods

Approximate methods; Raleigh-Ritz procedure; Energy methods; Formulation of the element stiffness matrix; Isoparametric elements; Axisymmetric analysis; Plate and shell structures; Dynamic problems; Practical applications. Computer packages will be extensively used.

Prerequisite: Suitable background in Mechanics and Mathematics

MECN7027A Discrete Event Simulation

The course is designed to introduce basic probability theory and then apply 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.

MECN7028A Lean Manufacturing

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. Lean and Six Sigma. Introduction to Lean in service, introduction to Lean new product introduction.

MECN7029A Mathematical Topics for Engineering Management

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.

MECN7032A Management Accounting

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.

**MECN7033A  Automotive Engineering**

The course is made up of topics related 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.

Prerequisite: Suitable background in Thermodynamics
Corequisite: MECN7028A Lean Manufacturing

**MECN7034A  Bulk Solids Storage and Handling**

Basic properties of bulk solids and particulates and basic concepts used to design bulk solids handling and processing equipment are presented based on problems from industry. This course is to provide a comprehensive introduction to the subject of Bulk Solids Handling. It demonstrates the importance of flow property measurements and the application of this information to the design of storage bins, feeding and handling equipment. The content of this programme is based largely on the principles of granular mechanics.

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 1 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.

**MECN7035A  Belt Conveying of Bulk Solids**

The course will provide 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.

**MECN7051A  Business to Business Marketing**


**MECN7053A  Systems Engineering Management**

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.
**Prerequisite:** At least 3 years of relevant working experience in industry

**MECN7058 Systems Engineering: Hard Systems Methodologies**

**MECN7054A Systems Engineering: Soft Systems Methodologies**


**MECN7055A Requirements Analysis in Systems Engineering**

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. Students 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.

**Prerequisite:** At least 3 years of relevant working experience in industry

**MECN7056A Systems Engineering: Architecture**

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.

**Prerequisite:** At least 3 years of relevant working experience in industry; MECN7058A; MECN 7055A

**MECN7057A Enterprise Engineering**

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.
MECN7058A Systems Engineering: Hard Systems Methodologies

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.

Prerequisite: At least 3 years of relevant working experience in industry

MECN7059A Supply Chain Management

The course aims to give 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.

MECN7060A Operations Management for Mining Systems

This course considers operations management in the mining context from a systems perspective, considering the unique context and challenges of the mining environment. Topics covered include current state analysis, value chain mapping, process analysis, constraint identification, root cause analysis, metrics and measures, problem solving methodologies and principles of systems engineering and thinking. There is a focus on organisational behaviour and soft systems issues.

MECN7061A Extended Finite Element Methods and Meshfree Methods

Meshfree Methods (MMs)
Kinematics of strong and weak discontinuities
The Extended Finite Element Methods (XFEM)
Application of XFEM to 2-phase flow
Application of XFEM and MMs to Linear Elastic Fracture Mechanics
Introduction to Nonlinear Materials

MECN7062A Systems Engineering: An Overview

The course aims to provide the student 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.
MECN7063A Systems Engineering - Modelling and Simulation: Principles and Approaches

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.

MECN7064A Systems Engineering: Integration, Verification and Validation

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.

MECN7065A Service Engineering

The course aims to give 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.

MECN7066A Research Methods in Engineering (10 points)

The course aims to prepare the student 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 subproblems, identifying required data, variables and controls and data analysis. The course will also familiarises the student 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.

MECN7067A Financial Modelling for Nuclear Energy Projects

- Identifying risks relating to financing power generation projects and the management of such risks
- Preparing budgets for power generation projects
- Building a business case for alternate power generation projects with particular focus on Nuclear projects
- Matching resource requirements to budgets for project life cycles
MECN7068A Leadership of Nuclear Strategy

Concepts of strategic leadership in the development of organisations
- Project performance and their link to strategic goals
- Understanding stakeholders and managing their expectations and concerns including the use of power dynamics in the organisation
- Managing human resources to achieve strategic objectives
- Leading and managing a culture of innovation and self-development including creating a learning organisation
- Lead change initiatives, including those of mergers and acquisitions and management of joint ventures
- Creating and implementing a safety culture
- Strategic management of corporate social responsibility

MECN7069A Regulation and Security of Nuclear Energy Projects

- Enhancement of skills for managing safety and licensing and associated regulatory processes in accordance with up-to-date international standards and best practice
- Provision of up-to-date insight into topical nuclear and radiation safety and licensing issues
- Provide skills to manage interfaces between regulatory authorities, technical support organizations operator organizations, vendors and other stakeholders in the regulatory and licensing process over the lifetime of facilities and activities
- Basic elements of nuclear security: Prevention, Transport security, Detection, Response, Information security
- 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.
- Providing delegates with the essential knowledge of current legislation pertaining to the Nuclear environment

MECN7070A Strategic Management of the Nuclear Energy Project Lifecycle

- Conceptualization 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
MECN7071A  Pipeline Conveying of Bulk Materials
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.
Pneumatic conveying:
- Systems and components
- Gas-solid flows
- System design
- System operation

MECN7094A  The Air Transportation System
A study of air transportation as part of a global, multimodal transportation system, the course reviews the 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.

MECN7095A  Human Factors in the Aviation/Aerospace Industry
This course presents 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.

MECN7096A  Advanced Aerodynamics
In this course, students 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.

MECN7097A  Earth Observation and Remote Sensing
U.S. and International solar system exploration programs are reviewed and related 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.

MECN7098A  Aviation/Aerospace Simulation Systems
The course focus is 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 emphasizes 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.

**MECN7099A  Applications in Crew Resource Management**

In this course, students examine 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 student 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 student uses simulators and computer-based instruction to supplement academic instruction.

**MECN7100A  Unmanned Aerospace Systems**

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.

**MECN7102A  Advanced Rotorcraft Operations**

The course introduces the complexities of rotary wing flight systems and the advancements made to overcome them. The unique problems facing an organization 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.

**MECN7101A  Applications in Space: Commerce, Defence and Exploration**

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.

**MECN7103A  Aircraft and Spacecraft Development**

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 organizations 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.
MECN7104A  Aerospace Accident Investigation and Analysis
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 organization. A critical analysis of selected aircraft accidents and an evaluation of casual factors are covered.

MECN7105A  Airport Safety and Certification
This course provides a review and analysis 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.

MECN7107A  Human Factors in Unmanned Aerospace Systems
This course is designed to present 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.

MECN7106A  Management of Research and Development for the Aerospace Industry
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 organizations. 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.

MECN7108A  Lean Management of Healthcare Systems
This course considers operations management in healthcare from a systems perspective, considering the context and challenges of this unique environment. Topics covered include 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. This course will explore scheduling and planning for efficient practice. There is a further focus on organisational behaviour and soft systems issues.
MECN7109A  The Mechanics of Heavy Vehicles
The course will cover the broad topics of tyre forces, low-speed turning, yaw plane 'bicycle' models of articulated vehicles, stability and rollover. The UMTRI tyre model. Heavy vehicle suspensions, brakes and steering systems. Driver models. Thermal performance of brakes, brake modelling and ABS. Performance-based standards to assess vehicle safety: Low-Speed Swept Path, Frontal Swing, Tail Swing, Rearward Amplification, High-Speed Transient Offtracking, Dynamic Load Transfer Ratio, Yaw-Damping Coefficient, Trackability on a Straight Path, Static Rollover Threshold, Startability, Gradeability A and B, Acceleration Capability.

MECN7110A  Vehicle Dynamics and Automotive Engineering
The course will cover the broad topics of tyre forces, handling and stability, traction and braking, quarter-car analysis, pitch-plane analysis, and roll-plane analysis. The brush tyre model and Pacejka tyre model. Handling diagrams to determine the oversteer or understeer characteristics of the vehicle. The effect of load distribution, engine characteristics, gearing and braking torque on acceleration and braking. Analysis of body acceleration, working space and dynamic tyre force using a quarter car model. Wheelbase filtering. The ride versus vehicle stability trade-off.

SCHOOL OF MINING ENGINEERING

MINN1997A  Practical Training (Mining)
Practical training will take place over a minimum period of four weeks and must be undertaken at a Training Centre approved by the Head of School of Mining Engineering. It is intended for students with no previous mining experience and consists of lectures and practical work designed to familiarise students with basic activities in underground mining. Students with previous mining experience will be required to undertake eight consecutive weeks of vacation work as specified in the departmental guidelines for vacation work.

MINN1000A  Mining Graphics and Design
(21)  (4-0-3)  (1 term)

MINN1001A  Engineering Skills (Mining)
(15)  (6-2-0)  (1 term)
This course consists of the following modules:
Computing: Introduction to computers, operating systems, word processors, spreadsheets and graphics packages.

Graphics: Basic drawing skills, area and volume calculations, trigonometry, circle geometry, spatial positions, sketching, orthographic projections, 3-D drawing.

MINN2000A Computer Applications in Mining

(21) (1-0-2) (2 terms)
This course builds on the basic computing skills learnt in MINN1001 and extends to the use of these skills in applications relevant to Mining Engineering. Topics covered include an introduction to communication applications such as the internet and electronic mail, an introduction to CAD packages, and mine design packages.

Prerequisite: MINN1001A

MINN2001A Excavation Engineering

(27) (4-1-0) (2 terms)

Module 1: Powering systems
Fundamentals of powering systems for machines: electrical, pneumatic, hydropower and hydraulic (mineral oil and emulsion systems).

Module 2: Mechanical Excavation and Rock Drilling

Module 3: Explosives
History, classification and composition of explosives, chemical and physical characteristics, fundamental chemical calculations, mechanics of detonation, hydrodynamic theory of detonation, ideal and non-ideal detonation, theory of initiation.

Module 4: Rock breaking and blasting applications
Mechanism of rock breaking, propagation of shock waves in solid medium, interaction of compressive waves from free face, mechanics of breaking rock, crack propagation, interaction from cracks, current research.

Underground blasting: stoping practice, sequential firing.

Surface mining blasting: Bench blasting, initiation patterns, drilling patterns, ground vibration and air blast.

Prerequisite: MATH1014A, PHYS1014A, PHYS1015A, MINN1001A

MINN2004A Engineering Surveying

(21) (4-1-3) (1 term) and Qualifying course for BSc(QSS) and BSc(CMS)

Module 1: Introduction to Surveying
Introduction to Surveying, theory of measurement errors, surveying instrumentation, observation and reduction of observations, leveling, taping and electronic distance measurement, setting out, longitudinal and cross sections, cut and fill and mass-haul diagrams, areas and volumes. South African co-ordinate system, use of hand-held and survey GPS systems.
Module 2: Surveying calculations

Module 3: Survey camp (1 week full-time in winter vacation)

MINN1996A Practical Workshop Training (Mining)

Practical Workshop Training (1 week)
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.

MINN1998A Vacation Work I (Mining)

Vacation Work I (8 weeks)
The first period of vacation work should be completed during a period of eight consecutive weeks in the year succeeding that in which credit is obtained for second year. The vacation work should take place at an approved training centre or on a mine and should be according to the departmental guidelines for vacation work. 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.

MINN3000A Industrial and Research Seminars I

(12) (1-0-0) (2 terms)
The programme includes two types of seminar. One deals with research work undertaken within the School and at research establishments. The other involves experts from industry discussing projects of special or topical interest in mining and allied fields.

MINN3001A Mine Transportation

(15) (4-1-0) (1 term)
Description of the following systems and their production capabilities. Consideration of the mechanics of operation and the basis for performing calculations to determine cycle times, sizes and numbers and powers and strengths.

Module 1: Bulk solids handling
(a) Conveyor systems – conventional, cable belt, Japan pipe conveyor, high angle conveyors, calculation of power requirements and carrying capacity of belts. (b) Aerial transportation. (c) Underground scraper winch systems. (d) Railway trammimg systems for rock, men and material. (e) Broken rock loading machines – rope shovels, hydraulic mining shovels, front end loaders, trackless load haul dump courses.

Module 2: Selected topics
a) Tyres, haul roads and ancillary surface mining equipment. (b) Hydraulic transportation of solids. (c) Hoisting systems – single drum, double drum, Blair Multi Rope, Koepe friction winding, calculation of payload requirements of hoisting systems, R.M.S. calculations. (d) Technology in transportation.

Prerequisite: APPM2014A
MINN3002A  Mining Engineering Laboratories

(9) (0-0-3) (2 terms)

Module 1: Rock mechanics tests
Three tests are demonstrated which deal with specimen preparation, uniaxial compressive strength, tensile strength, triaxial compressive strength, shear strength and static elastic parameters of rock.

Module 2: Environmental engineering tests
Five tests which deal with the following environmental aspects: fan tests, determination of characteristics of fans connected in series and in parallel, psychrometry testing, noise/hearing measurements, gravimetric dust monitoring and assessment techniques.

Module 3: Excavation engineering tests
Two sets of tests are demonstrated which are concerned with relieved, and non-relieved cutting behaviour of cutting picks.

Prerequisite: MINN2001A
Corequisites: MINN 3011A, MINN3006A

MINN3003A  Technical Valuation

(18) (4-2-0) (1 term)

Module 1: Sampling of Mineral Deposits
The goal of good sampling, Gy's seven sampling errors, material variation errors, sampling process errors, tools and techniques of sampling, the fundamental sampling error, the sampling nomogram, safe/unsafe sample reduction diagram, experimental calibration of the liberation factor, building sampling nomograms based on ‘calibrated’ constants.

Module 2: Statistical evaluation methods
Descriptive statistics; inference from Normal distributions, estimation of mean and standard deviation, confidence levels on parameters, hypothesis testing. Student’s t and f – ratio tests, correlation and regression methods, tests of significance, multivariate regression and trend surface analysis, inference from lognormal distributions, estimation of mean and confidence levels. Grade/tonnage curves.

Module 3: Geostatistical evaluation methods
Inverse distance techniques, calculation and modelling of semi-variograms, estimation of unknown values, ordinary and universal kriging, volume/variance relationships.

Module 4: Geostatistical applications
Valuation and mine economics; mine process flow; mining factors; economic effects of dilution and recovery; Samrec code; reporting of resources and reserves; paylimits; economic and planning cut-off grades; grade control.

Prerequisites: MATH2012A
Corequisite: MINN3004A

MINN3004A  Computerised Mine Design

(15) (5-0-0) (1 term)

Prerequisite: MINN2000A, MINN2004A
Corequisites: MINN3003A; MINN3012A, MINN3013A

**MINN3006A  Rock Mechanics**

(15) (4-1-0) (1 term)

**Module 1: Mechanics of solids**
Two-dimensional analysis of stress and strain; linear elasticity; stresses and displacements around mining excavations; three-dimensional elasticity.

**Module 2: Strength and deformation characteristics of rock**
Intact rock properties; shear strength of discontinuities; mechanical properties of rock masses; Mohr-Coulomb and Hoek-Brown failure criteria.

**Module 3: Mine Tour**
A series of visits to mines and mining-related institutions as arranged by the School, held during the mid-year vacation.

Prerequisite: MATH2012A
Corequisite: MINN3002A

**MINN3011A  Mine Ventilation and Climate Control**

(15) (4-1-0) (1 term)

**Module 1: Ventilation**
Fluid mechanics, Bernoulli equation, airflow in airways, ventilation networks, regulators, booster fans, fans, fan characteristics, fans in series and parallel, dilution of dangerous gases, coal mine design, ventilation software.

**Module 2: Deep level mining climate control**
Psychrometry, heat, acclimatisation, refrigeration, cooling plant, cooling towers, spray chambers, ice plant, gold mine design.

Prerequisite: MATH2012A
Corequisites: MINN3002A, MINN3014A

**MINN3012A  Mine Surveying**

(21) (4-1-3) (1 term)

**Module 1: Theory:** Introduction to the importance of mine surveying in the efficient and safe running of a mine; understanding map projections, developable surfaces and distortions; principles of surveying and how they relate to mine surveying; transfer of surface surveys to the underground environment; underground mine surveying methods and their application to mine planning, design and safety; understanding surveying legal requirements and their application to the mining industry; combining mathematical and surveying principles for solving three dimensional mine design problems; interpretation of mine surveying results for improved decision making on a mine.

**Module 2: Practical:** distance measurement and treatment of measuring errors; levelling traversing (with tapes and total stations); vertical surveys; care of surveying equipment; using a gyro-theodolite to determine azimuth; GPS instruments; processing of observations and producing mine surveying records in terms of the mining laws.

**Module 3: Three-day camp during Easter break**
Prerequisite: MINN2004A
Corequisite: MINN3004A
**MINN3013A  Mining A**

(15) (4-1-0) (1 term)

**Module 1: Excavations**

The representation of deposits and excavations by plans, sections and isometric drawings. Primary access to underground workings through shafts, adits and inclines; shaft sinking through consolidated and unconsolidated ground; large excavations (hoist chambers, pump chambers); raise boring and tunnel boring.

**Module 2: Tabular mining methods**

Primary and secondary developments and panel layout in coal mines. Introduction to coal mining methods and equipment.

**Module 3: Access to reef deposits**

Primary and secondary developments (haulages, raises, winzes and ore passes); stope design. Introduction to reef mining methods and equipment.

**Module 4: Massive mining methods**

Access to massive ore bodies: Primary and secondary development (haulages, ore passes, drilling levels); stope design. Introduction to massive orebody mining methods and equipment.

**Module 5: Surface mining**

Access to surface orebodies: Vegetation removal; topsoil and subsoil removal and storage. Haul access and initial box cuts. Introduction to open-pit and strip-mining, quarrying, dredging and alluvial mining methods.

Prerequisites: MINN2001A
Corequisite: MINN3004A

**MINN3014A  Health, Safety and the Mining Environment**

(15) (4-1-0) (1 term)


Mining and the environment, legislation, mine water impacts, mine air impacts, mine land impacts, mining environmental impact assessment, pollution control, rehabilitation and mine closure.

Corequisite: MINN3011A

**MINN1999A  Vacation Work II (Mining)**

The second period of vacation work should be completed during a period of eight consecutive weeks in the year succeeding that in which credit is obtained for third year. The vacation work should take place on a mine and should be according to the departmental guidelines for vacation work. 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.

**MINN4000A  Mine Management Principles**

(12) (7-0-0) (1 term)

Business: what is a business; Management – what is it; History of Management Theory; Managerial Conceptual Thinking; Management Work within the business; Organising and the determinants of organisation; Planning; Controlling; Leading; Daily managerial
activities and tools; Time management; Attributes of a manager; Industrial relations and legislation.

**MINN4001A  Mine Management Techniques**

(12) (7-0-0) (1 term)

**Management Science:** Introduction to quantitative techniques; linear programming; PERT/Critical Path method; Queueing theory; inventory control.

**Risk management:** Risk management terminology; functions and principles of risk management; introduction to risk assessment; due diligence; requirements of the Mine Health and Safety Act (Act 29 of 1996).

**Project management:** Characteristics of a project; phases of a project; role of a Project Manager.

**Analytical Trouble shooting:** Problem solving, especially in production management.

**MINN4002A  Industrial and Research Seminars II**

(12) (1-0-0) (2 terms)

The programme includes two types of seminar. One deals with research work undertaken within the School and at research establishments. The other involves engineers from industry discussing projects of special or topical interest in mining and allied fields.

*Prerequisite:* MINN3000A

**MINN4003A  Mining B**

(15) (5-1-0) (1 term)

**Exploitation:** Historical and present-day methods of exploitation of hard rock deep tabular orebodies; Selection of a mining method; Siting of shafts; Shaft pillars and extraction; Mine design parameters; Shaft sinking; Shaft station layouts; Shaft safety; Major development layout, level and raise spacing, boxholes; Conventional and specialised development; Choice of stoping method; Conventional stoping activities; Productivity; Mechanisation of operations and special technologies.

**Design:** Practical design exercises for exploiting tabular ore deposits.

*Prerequisites:* All third-year courses

*Corequisite:* MINN4006A

**MINN4004A  Mining C**

(15) (5-1-0) (1 term)

Two modules run in parallel, Module 1 consisting of a series of lectures and Module 2 consisting of tutorial and self-work periods in the mine design laboratory.

**Module 1: Mining methods**

The safe and efficient exploitation of underground coal deposits by means of bord and pillar, pillar extraction, rib-pillar, shortwall, longwall and specialised thick- and thin-seam techniques. Coal mining equipment, panel design and production potential. Coal as a commodity; its quality, utilisation and marketing.

**Module 2: Design**

The geological modelling of a coal deposit from borehole logs, market identification, plant design, mine design, layout scheduling and financial valuation of a coal mining project.

*Prerequisite:* All third-year courses

*Corequisite:* MINN4006A
MINN4005A  Financial Valuation

(18) (5-2-0) (1 term)

Module 1: Introduction to financial analysis: Introduction; financial statements; behaviour of costs; time value of money; capital value decisions; inflation; discounted cash flow models. Funding: sources of funding, cost of capital, gearing; Revenue: metals and minerals market, price influences, hedging and option pricing, margins and marginality; Reporting: annual reports, financial statements, competent persons report, valuations and acquisitions, takeovers.


Prerequisite: MINN3003A

MINN4006A  Mine Design

(21) (0-5-0) (1 term)

Assessment of the profit potential of a mining venture from basic exploration data which may concern either a gold deposit, a coal deposit or a base mineral deposit. After the derivation of a geological model, means of mining the deposit will have to be formulated and assessed and surface infrastructure requirements planned. Environmental impact considerations must be incorporated into the assessment at all relevant stages. Total capital requirements will have to be estimated and the rate of capital expenditure to match production build-up, will also have to be derived. Estimates of operating costs will be required in order to complete a full financial analysis so that the profitability and present value of the mine can be determined.

Prerequisite: All third-year courses
Corequisite: All other fourth-year courses

MINN4007A  Project Report

(15) (0-0-0) (1 term)

A project report (12 weeks) on an approved subject in the form of a paper for publication in a scientific journal. Technical report writing: technical style, literature search, organisation of information, graphic presentation, editing, typographic presentation.

NB: Students are given an introductory lecture on report writing and project presentation. Each student is allocated to a supervising lecturer; contact between supervisor and student is on an individual basis. Students are expected to attend a minimum of 5 sessions, approx. an hour per session. This number of contact sessions can be increased at the discretion of the supervisor, subject to progress made on the project.

Corequisite: All other fourth-year courses

MINN4008A  Mining D

(15) (5-1-0) (1 term)

Exploitation of massive orebodies: open stoping, room and pillar mining, cut and fill stoping, shrinkage mining, post pillar cut and fill mining, block caving, continuous block caving, forced caving, sublevel caving, sundry mining methods.
Trackless mining: selection and operation of underground trackless equipment for massive mining.

Design: Practical design exercise.

Prerequisites: All third-year courses

Corequisite: MINN4006A

**MINN4009A  **Mining E

(15) (5-1-0) (1 term)

Module 1: Open pit design; slope stability in relation to design; economics and stripping ratios; economic cut-offs; pit optimisation.

Module 2: Strip mining of coal; strip mine design and planning; economics of strip mining; environmental considerations; health and safety in surface mining, dragline operations; range diagrams.

Module 3: Marine mining; dredging; mechanised earthmoving; hydraulic mining; equipment selection; power systems; matching and fleet optimisation using queuing theory; gradeability; cycle times.

Module 4: Practical design exercise.

Prerequisites: All third-year courses

Corequisite: MINN4006A

**MINN4010A  **Rock Engineering

(18) (4-2-0) (1 term)

Module 1: Introduction and mainly theoretical considerations

The design process, relationship with Code of Practice to combat rockburst and rock fall accidents, behaviour of rocks and rock masses, continuum behaviour, behaviour of beams, discontinuum behaviour, stability of slopes in open pit mines and quarries.

Module 2: Applications considerations

Behaviour of jointed rock masses, rock mass classification, methods of improving stability, support of mining excavations including pillar and installed support design, shafts and their protection, rockbursts and rock falls, probability and risk.

Module 3: Mine Tour

Visits to mines and mining related institutions as arranged by the School, to be held during the mid-year vacation.

Prerequisite: MINN3006A

**Postgraduate courses**

(All courses 20 points unless otherwise indicated)

**MINN7000A  **Principles of Ventilation

Syllabuses for Engineering & The Built Environment

Mine ventilation and refrigeration planning. Refrigeration systems and ice with combinations thereof.

MINN7001A  Environmental Engineering 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.

MINN7005A  Mechanical Properties of Rocks and Rock Masses

MINN7006A  Geostatistical Methods in Mineral Evaluation
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.

MINN7007A  Statistical Valuation of Ore Reserves
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.

MINN7008A  Numerical Modelling Techniques in Rock Engineering
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.

MINN7009A  Trackless Mechanised Mining
The requirements of a mechanisation culture. Planning requirements for a mechanised operation. Mechanisation in massive mining operations (eg 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.

MINN7010A  Advanced Mechanics of Solids
Analysis of stresses and strains in three dimensions. Basic equations of compatibility and equilibrium. Constitutive relations and energy of deformation. Stress-strain relations for

MINN7012A Study and Control of Mining Induced Seismicity


MINN7013A Surface Subsidence due to Underground Mining

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.

MINN7014A Mineral Economics

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.

MINN7015A Mineral Policy and Investment

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.

MINN7016A Beneficiation Economics

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.

MINN7017A Environmental Economics

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.

**MINN7018A  Design of Support Systems for Underground Mine Workings**


**MINN7022A  Mechanics and Design of Major Rock Slopes**


**MINN7023A  Coal - Its Quality and Utilisation**

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.

**MINN7024A  Geographical Information Systems**

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.

**MINN7025A  Mining and the Environment**

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.

**MINN7026A  Economic Geology of Mafic/Ultramafic Igneous Rocks**

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.

**MINN7027A  Geology of Base Metal Deposits**

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 modeling. The course involves fieldwork and a project.

**MINN7028A  Economic Geology of South African Coal**

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.

**MINN7029A  Applied Geophysics in Mining Exploration**

Introduction to 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.

**MINN7030A  Economic Geology of Lode Gold Deposits**

Geology of lode-gold deposits in southern Africa with some examples from elsewhere. Overview of the deposits in terms of geological setting, minerology, 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 minerology and techniques for exploration.

**MINN7031A  Economic Geology on Witwatersrand Mines**

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, minerology, 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.

**MINN7033A  Practical Application of Simulation Techniques**

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.

**MINN7034A  Mine Design – Underground Coal Mining**

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.

**MINN7036A  Rock Mass Classification in Rock Engineering**

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.

MINN7037A Blasting Technology

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).

MINN7038A Minerals Marketing


MINN7039A Economics of Energy Resources

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.

MINN7041A Decision-making for Mining Investments

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.

MINN7043A Practical Implementation of Geostatistical Ore Evaluation Techniques

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.

MINN7046A Atmospheric Environmental Control and Mining

Introduction to 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.

**MINN7047A Coal Extraction and Exploitation**

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.

**MINN7048A Coal and the Environment**


**MINN7049A Risk Management in Mining**


**MINN7050A Mineral Resource Management**


**MINN7052A Compliance and Reporting Rules in the Minerals Industry**

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.

**MINN7053A Economic Definition of Ore**

Development and application of cutoff grades in the minerals industry. Linking of cutoff grades to short and long term planning and optimisation, and to the maximisation of value of minerals projects. Development of dynamic cutoff 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.

**MINN7054A  Theoretical Simulation Techniques**

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.

**MINN7055A  Advanced Mine Valuation**

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.

*Prerequisite: MINN7004A or equivalent*

**MINN7056A  Analytical Techniques and Quality Assurance**

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.

**MINN7057A  Enterprise Risk Analysis in Mining Projects**

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.

**MINN7058A  Evaluation of Risk as a Decision-making Criterion**

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.
MINN7059A  Investigational Project A (40 points)
The course consists of a project in which a problem or topic in the general field of Mining Engineering is investigated, and recommendations are made regarding the solution to the problem or topic. A comprehensive report covering the investigative process and describing the solution is to be submitted. The candidate is required to demonstrate competencies in the investigation, evaluation and technical reporting. The course requires submission of a formal proposal on initiation and a formal progress presentation during the period of the course. The completion of at least one, and a maximum of two, investigational projects, is a requirement for the M Eng Degree.

MINN7060A  Investigational Project B (40 points)
The course consists of a project in which a problem or topic in the general field of Mining Engineering is investigated, and recommendations are made regarding the solution to the problem or topic. A comprehensive report covering the investigative process and describing the solution is to be submitted. The candidate is required to demonstrate competencies in the investigation, evaluation and technical reporting. The course requires submission of a formal proposal on initiation and a formal progress presentation during the period of the course. The completion of at least one, and a maximum of two, investigational projects, is a requirement for the M Eng Degree.

MINN7061A  Sampling Theory and Methods
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.

MINN7062A  Probability and Risk in Rock Engineering
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.

MINN7063A  Grade Control Techniques and Applications
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.

MINN7064A  Selected Topics in Engineering
A selected topic is a research based assignment as approved by the Postgraduate Coordinator.

MINN7065A  Strategic Planning in Mining
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 organizations 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.

**MINN7066A  Open Pit Planning and Optimisation**

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.

**MINN7067A  Option Pricing in Mining**

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.

**MINN7068A  Enterprise and Financial Risk in Mining**

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.

**MINN7069A  Strategy, Operations and Risk Management for Minerals Resources Companies**

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.

**MINN7070A  Real Options in Mining Applications**

The course will examine 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.

**MINN7071A  Planning a Block Cave**

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.
MINN7072A Block Caving Principles

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 drawpoints 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.

MINN7073A Block Cave Construction and Production

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.

MINN7074A Slope Stability Monitoring

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.

MINN7075A Accident Investigations in Mining and Related Industries

To examine:
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.

MINN7076A Sustainable Development in Mining and Industry

The Sustainable Development in Mining and Industry Course will examine the following:
To examine the relationship between sustainable development and business including Safety, Health, Environment as well as Community issues in mining and industry. To introduce basic sustainable development terminology and concepts including those related to reporting and assessment. To demonstrate how sustainable development concepts are used in practically in the work environment in developing strategy, risk assessment and aligning business structures.

The course will enable participants to:

Describe the benefits of adopting sustainable development as a framework for business models.

Describe the core concepts of sustainable development.

Apply sustainable development concepts to business tools and structures.

Identify relevant sustainable development indicators for different industries.

**MINN7078A Safety & Health Leadership and Human Factors**

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 (i) apply leadership concepts in analysing and developing safety and health leadership strategies and (ii) incorporate human factor theory into the design and analysis of strategies for reducing safety and health risks and preventing accidents.

**MINN7079A Safety, Health, Environment and Community Systems**

The Safety, Health, Environment & Community Systems Course will examine the following:

- Why systems are needed?
- 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
- Audit protocols.
  - Common audit protocol
  - External Audits
  - Internal Audits
- Interaction of the SHEC Systems with the business system.
  - Leadership and SHEC climate
- Information system.
  - Leading and lagging indicators
- Interaction with Enterprise-wide Risk Management.
MINN7080A Earth Moving Equipment, Technology and Management

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.

MINN7082A Occupational Health and Hygiene for Non-Specialists

The Occupational Health & Hygiene Course will examine the following:

- Occupational hygiene as the science behind health.
- The management of the occupational environment.
- The conditions or practices conducive to health.
- 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.
- Occupational Health and Hygiene management systems.
- The legal framework as well as compensation mechanisms.
- National milestones on occupational health.
- Wellness in the workplace as a framework to show interdependencies between the Social as well as occupational environment.
- Surveillance; pro-active as well as re-active.

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.

MINN7083A Rock Cutting Technology

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.

MINN7084A Socio-Economic Development in Mining Communities

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.

MINN7085A Valuation of Mineral Assets

This module focuses on the purposes, principles, scope and context of Mineral Asset valuation. It will cover 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.

The outcome of this module will be that the student has an understanding of International Mineral Asset Valuation practice, and the purposes and uses of valuations. It allows the student to differentiate between asset based valuations, through to security valuation and company valuations, and to have gained an understanding of the risks associated with each.

**MINN7086A Valuation and Accounting Standards**

This module 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.

It also deals with International Financial Accounting Standards applied to the Extractive Industries, and the implications for valuation.

In this module, 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.

The module therefore covers:

- 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
- CIMVAL, 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.

MINN7087A Approaches to Valuation in Extractive Industries

This module considers the application of the three approaches to valuation, these being:

• 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.
• 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.
• Income Based Approaches.
Income based approaches include Discounted Cashflow techniques and Option Pricing Methods, as well as total cashflow methods. This module 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.

MINN7088A Advanced Mineral Asset Valuation

This module raises the valuation scope to Company and Security levels. This means 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.

MINN7089A Mine Planning Principles

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 geometallurgy 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.

**MINN7090A Planning and Optimisation of Underground Mines**

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.

**MINN7091A Planning and Optimisation of Surface Mines**

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.

**MINN7092A Mine Financial Valuation**

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.

**MINN7093A Applied Operations Research in Minerals Resources Management**

This course focuses on the application of operations research techniques to the minerals industry, particularly in Mineral Resource Management, in order to optimize 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 optimization; global optimization as applied to mining; queuing theory as applied to mining; dispatch optimization; 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 optimization; course project assignment.

**MINN7094A Research Methodology for Mining Engineering**

This course prepares students for research in a structured framework that provides a systematic approach to the analysis of research questions. The course is a specific aid for learners 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 research proposal which forms the basis for the assessment of their competence in terms of Research Methodology. Students 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. 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.

**SCHOOL OF MOLECULAR MEDICINE AND HAEMATOLOGY**

**HAEM2001A Molecular and Cell Biology for Biomedical Engineers**

(9) (3-0-0) (1 term)

Basics of molecular and cell biology, including terminology, cell function, membrane physiology, bioinformatics and selected topics covering state-of-the-art developments. Ethics of cellular research will also be discussed.
SCHOOL OF PHYSICS

PHYS1014A  Physics IE

(30) (4-1-3) (2 terms)

Geometrical optics: Reflection and refraction at plane surfaces; prisms and dispersion; refraction at curved surfaces; lenses and image formation; optical instruments.

Thermal physics: Temperature scales, thermal expansion; phase changes; equivalence of heat and work; heat capacities; heats of transformation; conduction, convection, radiation; gas laws; kinetic theory of gases; equipartition of energy, heat capacities of gases.

Hydrostatics: Pressure; Pascal’s principle; Archimedes’ principle, floating and submerged bodies. Hydrodynamics: Streamline flow, continuity; Bernouilli’s equation; viscosity, Poiseuille’s equation; Stokes’ equation; turbulence, Reynolds number.

Waves: Travelling waves: superposition, interference, reflection and transmission of waves; standing waves; beats; Doppler effect; shock waves.

Physical optics: Electromagnetic spectrum, speed of light; coherence, twin slit interference, thin film interference; single slit diffraction and the grating; polarisation; resolution.

Surface tension: Surface energy, angle of contact, curved surfaces, capillary action.

Electricity: Coulomb’s law, electric field, flux, Gauss’ theorem; potential difference; capacitors, dielectrics, stored energy, dipoles; current electricity, resistance, Ohm’s law, emf, energy and power; Kirchhoff’s laws, Wheatstone bridge; instruments.

Magnetism: Magnetic field, flux, force on a current, motion of charged particles, torque on loop, Hall effect; Ampere’s law: Faraday’s law, self and mutual inductance, magnetic properties of matter, B-H loops.

Modern physics: Atomic physics, waves and particles, X-rays, radioactivity, binding energy, fission, fusion; Bohr model of atom; radiation dosimetry.

PHYS1015A  Mechanics

(30) (3-2-0) (2 terms)


PHYS1025A  Physics

Qualifying course for BSc(CS), BSc Eng (Chem) and BSc Eng (Met & Mat)

OPTICAL PHENOMENA


Geometrical Optics (Plane Interfaces): Nature and Propagation of Light, Reflection and Refraction at an Interface, Reflection and Refraction at a Plane Interface, The Prism

Physical optics: Interference, Diffraction, Polarization

PROPERTIES OF MATTER


Elasticity: The Hookian Spring, Stiffness constant, Stress and Strain, (Tensile, Shear, Torsion, and Bulk), Elastic Moduli, Strength of Structures.


Thermal Comfort: Vapour pressure, Humidity, P-T diagrams, Condensation, Dew point, Thermal environment, temperature control and balance, Human comfort.

ELECTRICITY AND MAGNETISM


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.


PHYS1028A  Physics IE (Part Time)

(30) (4-1-3) (2 terms)

Geometrical optics: Reflection and refraction at plane surfaces; prisms and dispersion; refraction at curved surfaces; lenses and image formation; optical instruments.

Thermal physics: Temperature scales, thermal expansion; phase changes; equivalence of heat and work; heat capacities; heats of transformation; conduction, convection, radiation; gas laws; kinetic theory of gases; equipartition of energy, heat capacities of gases.

Hydrostatics: Pressure; Pascal’s principle; Archimedes’ principle, floating and submerged bodies. Hydrodynamics: Streamline flow, continuity; Bernouilli’s equation; viscosity, Poiseuille’s equation; Stokes’ equation; turbulence, Reynolds number.

Waves: Travelling waves: superposition, interference, reflection and transmission of waves; standing waves; beats; Doppler effect; shock waves.

Physical optics: Electromagnetic spectrum, speed of light; coherence, twin slit interference, thin film interference; single slit diffraction and the grating; polarisation; resolution.

Surface tension: Surface energy, angle of contact, curved surfaces, capillary action.

Electricity: Coulomb’s law, electric field, flux, Gauss’ theorem; potential difference; capacitors, dielectrics, stored energy, dipoles; current electricity, resistance, Ohm’s law, emf, energy and power; Kirchhoff’s laws, Wheatstone bridge; instruments.

Magnetism: Magnetic field, flux, force on a current, motion of charged particles, torque on loop, Hall effect; Ampere’s law: Faraday’s law, self and mutual inductance, magnetic properties of matter, B-H loops.

Modern physics: Atomic physics, waves and particles, X-rays, radioactivity, binding energy, fission, fusion; Bohr model of atom; radiation dosimetry.

PHYS1029A  Mechanics (Part Time)

(30) (3-2-0) (2 terms)


**PHYS2007A  Physics II (Electrical)**

(15) (3-1-1) (1 term)


**Introduction to Quantum Mechanics:** Young’s double slit experiment – quantum mechanical behaviour, Wave functions, Operators, Schroedinger’s Time-Dependent Wave Equation, Calculating Observables, Schroedinger’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.


**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.

*Prerequisites:* PHYS1014A, MATH1014A

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**SCHOOL OF PHYSIOLOGY**

**PHSL2004A  Physiology and Medical Biochemistry I**

(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.

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**SCHOOL OF SOCIAL SCIENCES**

**HIST1010A  A Social History of Technology**

(9) (2-1-0) (1 term)

The course will examine technological innovations as a cause of economic development in general, and in the establishment of capitalism in particular. It will explore how far a developing scientific method was promoted or constrained by the willingness of specific historical societies to accept and exploit innovation. Beginning with the life of Leonardo, we will consider the influence of practical innovation and scientific thought on medieval
and early modern Europe. The example of Von Neumann will then take us to a very
different world, where the scientist had become part of a recognisable community of
scientists, and where technology was advancing to take an ever greater control over the
environment.

**PHIL1001A Critical Thinking and Philosophical Reasoning**

(12) (2-1-0) (1 term)
This course will introduce students to some elementary formal and informal logic, as well
as examine different forms that arguments take. Special attention will be given to scientific
reasoning, as well as some basic issues in the Philosophy of Science. It will also introduce
students to elementary ethical thinking and reasoning, with a focus on ethical issues that
arise in Engineering contexts.

**POLS3017A Liberty, Justice and the Politics of Difference**

Qualifying course for BSc(URP)
This course explores the major developments in normative political theory since the
revival of the sub-discipline in the 1970s. Its focus is on the three major themes. The first
is the relationship between the citizen and the state, taking in issues of globalisation and
social contract theory. The second is distributive justice, covering among other issues the
relationship between liberty and equality. The final theme considers more recent debates
around citizenship and difference, in particular the question of how democratic states
accommodate gender diversity and group-rights claims that accompany contemporary
multiculturalism. In the course of examining these topics students will be introduced to
diverse philosophical standpoints including those of liberalism, conservatives, socialism,
anarchism and feminism.

**SOCL1013A Southern Africa in the Era of Globalisation I**

(18) (2-1-0) (1 term)
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 aims to develop students’ research and critical thinking skills, so
that they can make sense of the changing social world.

**SOCL1014A Identity and Society I**

Qualifying course for BSc(URP)
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.

**WITS SCHOOL OF ARTS**

**WSOA1011A Key Concepts in Game Design IA**

(18) (2-1-1) (1 term)
The course will introduce 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.

**WSOA1012A  Key Concepts in Game Design IIB**

(18) (2-1-1) (1 term)

The course will continue 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 will be delivered in lab sessions, will require the analysis and production of analogue games using the theory introduced.

**WSOA2006A  Digital Art Design Project**

(24) (2 -1 -1) (1 term)

Design project that will extend the duration of the semester. 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. The project will be the creation of design artwork that focuses on concepts of object design, play, and interaction. It will also be an exploration in audience engagement, as students will design and test projects on and with their piers. The course will begin with a three week series of workshops in which students will be introduced to the area of the project, the tools and materials they are expected to use for the project. A second three week period will be dedicated to the formation of groups and project proposals based on initial tools presented. In the last six weeks students will meet regularly with supervisors in the development of projects, testing and project documentation.

**WSOA2009A  Introduction to Game Creation IIA**

(24) (2 -1 -1) (1 term)

Students will learn the history of and the technology for creating digital 2D games. In the practical part of the course, students will learn how to apply different game design and creation techniques.

**WSOA2010A  Introduction to Game Creation IIB**

(24) (2 -1 -1) (1 term)

Students will learn the history of and the technology for creating digital 2D games. In the practical part of the course, students will learn how to apply different game design and creation techniques.

**WSOA3000A  Introduction to the World Wide Web as Creative Medium III**

(18) (2 -1 -1) (1 term)

Net.Art is an exciting new area of creative and technical exploration which uses the capabilities of the Internet to communicate artistic and political ideas to a global viewership. This course will introduce you to the main currents of contemporary Net.Art together with an understanding of how the Web works as a communicative system. At a practice level you will receive hands on introduction to basic web coding techniques and creative projects which will teach you how to use the Web as a communicative and artistic tool.

**WSOA3003A  Game Design IIIA**

(18) (2 -1 -1) (1 term)

The course will expand on the main concepts and key theories of game design introduced in previous years. It would build 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. The focus of this course is on theory and close case studies of selected games, as well as on applying these in practical game design.

**WSOA3004A Game Design IIIB**

(18) (2 -1 -1) (1 term)

The course will expand on the main concepts and key theories of game design introduced in previous years. It would build 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. The focus of this course is on theory and close case studies of selected games, as well as on applying these in practical game design.