

# University of Pretoria Yearbook 2017

## BEng Civil Engineering ENGAGE (12136007)

**Duration of study** 5 years

**Total credits** 600

### Programme information

**Please note:** The Engineering Augmented Degree Programme (ENGAGE) is an extended degree programme with a five-year curriculum. It is designed to enable students who show academic potential but who do not meet the normal entry requirements for the four-year degree programme, to obtain an Engineering degree. ENGAGE students spend the first three years of the programme covering the content of the first two years of the four-year degree programme. They also take compulsory augmented modules in each of the Level 1 subjects. These augmented modules provide students with background knowledge and skills needed to succeed in an engineering degree. The curriculum for years four and five of the ENGAGE programme are identical to the curriculum for years 3 and 4 of the 4-year programme, respectively. Students may apply directly for admission to the programme.

- Students must register for the entire programme, not components of it. The curriculum is fixed; there are no electives.
  - Attendance at all components of years 1 to 3 of the programme is compulsory. Non-attendance will only be condoned in the case of illness (sick note required) or family crisis (e.g. a death in the family), in which case students must inform the programme administration immediately.
  - Students who fail to meet the attendance requirement for any module in any semester of years 1 to 3 of the programme will be excluded from the programme.
  - No augmented module may be repeated more than once.
  - Selection into the programme will be based on a combination of performance in the National Senior Certificate examinations or equivalent and other selection tests approved by the faculty.
  - A student who fails a mainstream module (e.g. Chemistry) but passes the associated augmented module (e.g. Additional chemistry) does not need to repeat the augmented module.
  - A student who fails an augmented module (e.g. Additional chemistry) but passes the associated mainstream module (e.g. Chemistry) does not need to repeat the mainstream module.
  - A student must meet the attendance requirement and obtain at least 40% for both the continuous assessment and test components as well as a final mark of 50% in order to pass an augmented module.
- i. The curricula of the fourth and the fifth years of study are identical to those of the third and the fourth years of the four-year programme.
- ii. JPO 110 is a prerequisite for JPO 120. Credit for JPO is obtained with a final mark of more than 50%. Conditional admission to JPO 120: If the final mark for JPO 110 is between 45% and 49%, a student can register for JPO 120 but credit for JPO 110 and JPO 120 will only be obtained if the final combined mark for JPO 110 and JPO 120 is above 50%.

**Please note:** All students will be required to successfully complete JCP 203, Community-based project 203, as part of the requirements for the BEng degree. A student may register for the module during any of the years of study of the programme, but preferably not during the first or the final year of study.

## Promotion to next study year

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

- A new first-year student who has failed in all the prescribed modules of the programme at the end of the first semester, is excluded from studies in the School of Engineering. A student who is registered for the Engineering Augmented Degree Programme and has passed only 8 credits will also be excluded.
- A student who complies with all the requirements of the first year of study, is promoted to the second year of study.
- A student who has not passed at least 70% of the credits of the first year of study after the November examinations, must reapply for admission should he/she intend to proceed with his/her studies. Application on the prescribed form must be submitted to the Student Administration of the School of Engineering not later than 11 January. Late applications will be accepted only in exceptional circumstances after approval by the Dean. Should first-year students be readmitted, conditions of readmission will be determined by the Admissions Committee.
- Students who have not passed all the prescribed modules at first year level (level 100), as well as students who are readmitted in terms of Faculty Regulations must register for the outstanding first-year level (level-100) modules.
- A student who is repeating his or her first year, may, on recommendation of the relevant heads of department and with the approval of the Dean, be permitted to enroll for modules of the second-year of study in addition to the first-year modules which he or she failed, providing that he or she complies with the prerequisites for the second-year modules and no timetable clashes occur. Students on the ENGAGE programme may, following the same procedure, be permitted to enrol for level-200 modules in addition to the level-100 modules which he/she failed providing that he/she complies with the prerequisites for the modules at 200-level and no timetable clashes occur. On recommendation of the relevant head of department and with special permission from the Dean, permission may be granted to exceed the prescribed number of credits. The total number of credits which may be approved may not exceed the normal number of credits per semester by more than 16 credits.
- Students in Computer, Electrical and Electronic Engineering, who fail a first-year module for the second time, forfeit the privilege of registering for any modules of an advanced year of study.

### **Please note:**

- From the second year of study each student should be in possession of an approved calculator. It is assumed that each student will have easy access to a personal computer.
- Students who intend transferring to Mining Engineering, must familiarise themselves with the stipulations set out in the syllabi of PWP 121 Workshop practice 121.

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

- a. A student who complies with all the requirements of the second year of study, is promoted to the third year of study.
- b. A student must pass all the prescribed modules at first year level (level 100) before he or she is admitted to any module at third year level (level 300).
- c. A student who is repeating his or her second year must register for all the second-year modules still outstanding. Such a student may, on recommendation of the relevant head of department and with the approval of the Dean, be permitted to enroll for modules of the third year of study in addition to the second-year modules which he or she failed, providing that he or she complies with the prerequisites for the third-year modules and no timetable clashes occur. On recommendation of the relevant head of department, and with special permission from the Dean, permission may be granted to exceed the prescribed number of credits. The total number of credits which may be approved may not exceed the normal number of credits per semester by more than 16 credits.
- d. Students in Computer, Electrical and Electronic Engineering who fail a second-year module for the second time forfeit the privilege of registering for any modules of the third year of study.
- e. Students who intend transferring to Mining Engineering must familiarise themselves with the stipulations set out in the syllabi of PWP 120 Workshop practice 120, as well as PPY 317 Practical training 317.

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

- a. A student who complies with all the requirements of the third year of study is promoted to the fourth year of study. A student who does not comply with all the requirements but who is able to register for all outstanding modules in order to complete the degree programme, may at registration be promoted to the fourth year of study.
- b. A student must pass all the prescribed modules of the second year of study, before he or she is admitted to any module of the fourth year of study.
- c. A student who has not passed all the prescribed modules of the third year of study, must register for the outstanding modules. A student may be admitted by the Dean, on the recommendation of the head of department concerned, to modules of the fourth year of study, in addition to the outstanding third-year modules, provided that he or she complies with the prerequisites of the fourth-year modules and no timetable clashes occur. The total number of credits per semester for which a student registers may not exceed the normal number of credits per semester by more than 16 credits. In exceptional cases, the Dean may, on recommendation of the relevant head of department, permit a student to exceed the above limit.
- d. Students in Computer, Electrical and Electronic Engineering who fail a third-year module for the second time, forfeit the privilege of registering for any modules of the fourth year of study.

## Pass with distinction

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

within the prescribed five years of the ENGAGE programme.

- b. Exceptional cases to the above will be considered by the Dean.



## Curriculum: Year 1

Minimum credits: 128

### Fundamental modules

#### Academic orientation 112 (UPO 112)

**Module credits** 0.00

**Language of tuition** Afrikaans and English is used in one class

**Academic organisation** EBIT Dean's Office

**Period of presentation** Year

### Core modules

#### General chemistry 171 (CHM 171)

**Module credits** 16.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology

**Prerequisites** No prerequisites.

**Contact time** 1 web-based period per week, 1 practical per week, 1 discussion class per week, 4 lectures per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Chemistry

**Period of presentation** Semester 1

##### Module content

General introduction to inorganic, analytical and physical chemistry. Nomenclature of inorganic ions and compounds, stoichiometric calculations concerning chemical reactions, redox reactions, solubilities and solutions, atomic structure, periodicity. Molecular structure and chemical bonding using the VSEPR model. Principles of reactivity, electrochemistry, energy and chemical reactions, entropy and free energy. Appropriate tutorial classes and practicals.

#### Physics 176 (FSK 176)

**Module credits** 16.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology

**Prerequisites** No prerequisites.

**Contact time** 4 lectures per week, 1 discussion class per week, 1 practical per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Physics

**Period of presentation** Semester 2

## Module content

Introductory mathematics: Symbols, exponents, logarithms, angles in degrees, radial measure, goniometry, differentiation, and integration. Motion along a straight line: position and displacement, acceleration. Vectors: adding vectors, components, multiplying vectors. Motion in two and three dimensions: projectile motion, circular motion. Force and motion: Newton's Law, force, friction. Kinetic energy and work: work, power. Potential energy: Centre of mass, linear momentum. Collisions: impulse and linear momentum, elastic collisions, inelastic collisions. Rotation: kinetic energy of rotation, torque. Oscillations and waves: Simple harmonic motion, types of waves, wavelength and frequency, interference of waves, standing waves, the Doppler effect. Temperature, heat and the first law of thermodynamics.

## Professional orientation 110 (JPO 110)

**Module credits** 8.00

**Prerequisites** Pass JPO 110. Conditional entry into JPO 120: JPO 110 mark between 45% and 49% . Pass JPO 110 and JPO 120: Final combined mark for JPO 110 and JPO 120 at least 50%.

**Contact time** 3 lectures per week, 3 tutorials per week, Foundation Course

**Language of tuition** Module is presented in English

**Academic organisation** EBIT Dean's Office

**Period of presentation** Semester 1

## Module content

A project-based approach is followed towards the development of skills needed for success in engineering. Skills include communication, information technology, technology, academic and life skills. The modules are presented in English.

## Professional orientation 120 (JPO 120)

**Module credits** 8.00

**Prerequisites** Pass JPO 110. Conditional entry into JPO 120: JPO 110 mark between 45% and 49% . Pass JPO 110 and JPO 120: Final combined mark for JPO 110 and JPO 120 at least 50%.

**Contact time** Foundation Course, 3 lectures per week, 3 tutorials per week

**Language of tuition** Module is presented in English

**Academic organisation** EBIT Dean's Office

**Period of presentation** Semester 2

## Module content

A project-based approach is followed towards the development of skills needed for success in engineering. Skills include communication, information technology, technology, academic and life skills. The modules are presented in English.

## Workshop practice 121 (SWP 121)

<b>Module credits</b>	6.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 other contact session per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Civil Eng
<b>Period of presentation</b>	Semester 2

#### Module content

\*Attendance module only

The module is offered at the end of the first year of study and lasts at least eight days during which the students receive training in the following workshops: formwork, scaffolding, masonry, welding and structural steel.

### Calculus 158 (WTW 158)

<b>Module credits</b>	16.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	Refer to Regulation 1.2: A candidate must have passed Mathematics with at least 60% in the Grade 12 examination
<b>Contact time</b>	4 lectures per week, 1 tutorial per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Mathematics and Applied Maths
<b>Period of presentation</b>	Semester 1

#### Module content

\*This module is designed for first-year engineering students. Students will not be credited for more than one of the following modules for their degree: WTW 158, WTW 114, WTW 134, WTW 165.

Introduction to vector algebra. Functions, limits and continuity. Differential calculus of single variable functions, rate of change, graph sketching, applications. The mean value theorem, the rule of L'Hospital. Indefinite integrals, integration.

### Additional Chemistry 1 111 (JPO 111)

<b>Module credits</b>	8.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	Foundation Course, 1 lecture per week, 3 tutorials per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	EBIT Dean's Office
<b>Period of presentation</b>	Semester 1

#### Module content

Background knowledge, problem-solving skills, conceptual understanding and chemical reasoning skills required by CHM 171/172.



### Additional Physics 122 (JPO 122)

<b>Module credits</b>	8.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	3 tutorials per week, 1 lecture per week, Foundation Course
<b>Language of tuition</b>	Module is presented in English
<b>Academic organisation</b>	EBIT Dean's Office
<b>Period of presentation</b>	Semester 2

#### Module content

Background knowledge, problem-solving skills, conceptual understanding and physical reasoning skills required by FSK 116/176.

### Additional Mathematics 1 116 (JPO 116)

<b>Module credits</b>	8.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	Foundation Course, 3 tutorials per week, 1 lecture per week
<b>Language of tuition</b>	Module is presented in English
<b>Academic organisation</b>	EBIT Dean's Office
<b>Period of presentation</b>	Semester 1

#### Module content

Background knowledge, problem-solving skills, conceptual understanding and mathematical reasoning skills required by WTW 158.

### Additional Mathematics 2 126 (JPO 126)

<b>Module credits</b>	8.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week, Foundation Course, 3 tutorials per week
<b>Language of tuition</b>	Module is presented in English
<b>Academic organisation</b>	EBIT Dean's Office
<b>Period of presentation</b>	Semester 2

#### Module content

Background knowledge, problem-solving skills, conceptual understanding and mathematical reasoning skills required by WTW 164.

### Humanities and social sciences 110 (HAS 110)

<b>Module credits</b>	8.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology



<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Anthropology and Archaeology
<b>Period of presentation</b>	Semester 1

#### Module content

Social sciences: Perspectives on contemporary society

An introduction to long-standing questions about the nature of human societies and contemporary challenges. Topics to be discussed include globalisation and increasing connectedness; rising unemployment, inequality and poverty; rapid urbanisation and the modern city form; transformations in the nature of work; environmental degradation and tensions between sustainability and growth; shifts in global power relations; the future of the nation-state and supra-national governance structures; and possibilities for extending human rights and democracy. Critical questions are posed about modern selfhood, sociality, culture and identity against the background of new communications technologies, ever more multicultural societies, enduring gender, class and race inequities, and the emergence of new and the resurgence of older forms of social and political identity. These issues are approached from the vantage of our location in southern Africa and the continent, drawing on social science perspectives.

### Humanities and social sciences 120 (HAS 120)

<b>Module credits</b>	8.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Afrikaans
<b>Period of presentation</b>	Semester 2

#### Module content

Humanities: Text, culture and communication

Successful communication of ideas, values and traditions depends on understanding both the literal and implied meanings of texts. In this module students are introduced to a variety of texts, including original literary and visual texts, with a view to developing an understanding of how textual meanings have been constructed and negotiated over time. Students are encouraged to understand themselves as products of – and participants in – these traditions, ideas and values. Appropriate examples will be drawn from, among others, the Enlightenment, Modernism, Existentialism, Postmodernism and Post-colonialism.

### Mathematics 164 (WTW 164)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	WTW 114 GS or WTW 158 GS
<b>Contact time</b>	4 lectures per week, 1 tutorial per week

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<b>Language of tuition</b>	Separate classes for Afrikaans and English
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<b>Academic organisation</b>	Mathematics and Applied Maths
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<b>Period of presentation</b>	Semester 2
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### **Module content**

\*This module is designed for first-year engineering students. Students will not be credited for more than one of the following modules for their degree: WTW 146, WTW 148 and WTW 124,

Vector algebra with applications to lines and planes in space, matrix algebra, systems of linear equations, determinants, complex numbers, factorisation of polynomials and conic sections. Integration techniques, improper integrals. The definite integral, fundamental theorem of Calculus. Applications of integration. Elementary power series and Taylor's theorem. Vector functions, space curves and arc lengths. Quadratic surfaces and multivariable functions.

## Curriculum: Year 2

**Minimum credits: 120**

### Core modules

#### Electricity and electronics 111 (EBN 111)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 tutorial per week, 1 practical per week, 3 lectures per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Electrical, Electronic and Com
<b>Period of presentation</b>	Semester 1

#### Module content

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

#### Community-based project 203 (JCP 203)

<b>Module credits</b>	8.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Informatics
<b>Period of presentation</b>	Year

#### Module content

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

#### Graphical communication 110 (MGC 110)

<b>Module credits</b>	16.00
<b>Service modules</b>	Faculty of Education
<b>Prerequisites</b>	No prerequisites.

<b>Contact time</b>	3 tutorials per week, 3 lectures per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Mechanical and Aeronautical En
<b>Period of presentation</b>	Semester 1

#### Module content

Freehand sketching covering the following: perspective, isometric and orthographic drawings. Drawing conventions, graphical techniques and assembly drawings. Evaluation of drawings and error detection. True lengths of lines, projections and intersections. Practical applications of these techniques. Introduction to computer-aided drawings, including dimensioning, crosshatching and detailing. Introduction to basic manufacturing processes including primary (casting, forging and extrusion) and secondary (drilling, turning, milling, grinding, broaching and sawing) manufacturing procedures.

### Materials science 123 (NMC 123)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 tutorial per week, 1 practical per week, 4 lectures per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Materials Science and Metallur
<b>Period of presentation</b>	Semester 2

#### Module content

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

### Mechanics 122 (SWK 122)

<b>Module credits</b>	16.00
<b>Service modules</b>	Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	WTW 158
<b>Contact time</b>	2 tutorials per week, 4 lectures per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Civil Eng
<b>Period of presentation</b>	Semester 1 or Semester 2

### Module content

Equivalent force systems, resultants. Newton's laws, units. Forces acting on particles. Rigid bodies: principle of transmissibility, resultant of parallel forces. Vector moments and scalar moments. Relationship between scalar- and vector moments. Couples. Equivalent force systems on rigid bodies. Resultants of forces on rigid bodies. Equilibrium in two and three dimensions. Hooke's law. Trusses and frameworks. Centroids and second moments of area. Beams: distributed forces, shear force, bending moment, method of sections, relationship between load, shear force and bending moment.

## Calculus 258 (WTW 258)

<b>Module credits</b>	8.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	WTW 158 and WTW 164
<b>Contact time</b>	2 lectures per week, 1 tutorial per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Mathematics and Applied Maths
<b>Period of presentation</b>	Semester 1

### Module content

Calculus of multivariable functions, directional derivatives. Extrema. Multiple integrals, polar, cylindrical and spherical coordinates. Line integrals and the theorem of Green. Surface integrals and the theorems of Gauss and Stokes.

## Numerical methods 263 (WTW 263)

<b>Module credits</b>	8.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	WTW 164
<b>Contact time</b>	1 tutorial per week, 2 lectures per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Mathematics and Applied Maths
<b>Period of presentation</b>	Semester 2

### Module content

Numerical integration. Numerical methods to approximate the solution of non-linear equations, systems of equations (linear and non-linear), differential equations and systems of differential equations. Direct methods to solve linear systems of equations.

## Additional Electricity and electronics 112 (JPO 112)

<b>Module credits</b>	8.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	Foundation Course, 1 lecture per week, 3 tutorials per week



<b>Language of tuition</b>	Module is presented in English
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<b>Academic organisation</b>	EBIT Dean's Office
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<b>Period of presentation</b>	Semester 1
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#### Module content

Background knowledge, problem-solving skills, conceptual understanding and reasoning skills required by EBN 111/122.

### Additional Graphical communication 113 (JPO 113)

<b>Module credits</b>	8.00
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<b>Prerequisites</b>	No prerequisites.
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<b>Contact time</b>	Foundation Course, 1 lecture per week, 3 tutorials per week
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<b>Language of tuition</b>	Module is presented in English
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<b>Academic organisation</b>	School of Engineering
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<b>Period of presentation</b>	Semester 1
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#### Module content

Background knowledge, conceptual understanding, drawing skills and reasoning skills required by MGC 110.

### Additional Materials science 123 (JPO 123)

<b>Module credits</b>	8.00
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<b>Prerequisites</b>	No prerequisites.
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<b>Contact time</b>	Foundation Course, 1 lecture per week, 3 tutorials per week
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<b>Language of tuition</b>	Module is presented in English
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<b>Academic organisation</b>	EBIT Dean's Office
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<b>Period of presentation</b>	Semester 2
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#### Module content

Background knowledge, problem-solving skills, conceptual understanding and reasoning skills required by NMC 113/123.

### Additional Mechanics 125 (JPO 125)

<b>Module credits</b>	8.00
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<b>Prerequisites</b>	No prerequisites.
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<b>Contact time</b>	3 tutorials per week, 1 lecture per week, Foundation Course
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<b>Language of tuition</b>	Module is presented in English
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<b>Academic organisation</b>	EBIT Dean's Office
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<b>Period of presentation</b>	Semester 2
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### **Module content**

Background knowledge, problem-solving skills, conceptual understanding and reasoning skills required by SWK 122.

## Curriculum: Year 3

Minimum credits: 128

### Core modules

#### Engineering statistics 220 (BES 220)

<b>Module credits</b>	8.00
<b>Prerequisites</b>	WTW 158 GS, WTW 164 GS
<b>Contact time</b>	1 tutorial per week, 2 lectures per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Industrial and Systems Eng
<b>Period of presentation</b>	Semester 2

##### Module content

Engineering systems are often subjected to variation, uncertainty and incomplete information. Mathematical statistics provides the basis for effectively handling and quantifying the effect of these factors. This module provides an introduction to the concepts of mathematical statistics and will include the following syllabus themes: data analysis, probability theory, stochastic modelling, statistical inference and regression analysis.

#### Civil engineering measurement techniques 221 (SBZ 221)

<b>Module credits</b>	8.00
<b>Prerequisites</b>	(SWK 210)
<b>Contact time</b>	2 lectures per week, 1 tutorial per week, 1 practical per week
<b>Language of tuition</b>	Module is presented in English
<b>Academic organisation</b>	Civil Eng
<b>Period of presentation</b>	Semester 2

##### Module content

Measurement instruments and measurement techniques used in engineering applications. Theory of the Wheatstone bridge and the application of strain gauges to measurement instruments. Accuracy, precision, resolution, hysteresis and linearity. Load cells, pressure sensors, displacement transducers, stress cells and inclinometers. Adjustment and use of plane table, level, compass and theodolite. Elementary site survey and levelling. Definition of survey. Coordinate systems and bearing. Method of determining levels. Tachometry.

#### Geomaterials and processes 210 (SGM 210)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	4 lectures per week, 3 practicals per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Geology





**Period of presentation** Semester 1

**Module content**

Solar system; Earth structure and systems; plate tectonics; classification and contextual setting of rocks and minerals; rock cycle. Internal and external geological processes; landscape formation; influences of geological environment on mankind. Geological time and the Earth's history through time. Practicals involving identification and description of crystals, minerals and rocks.

**Pavement materials and design 221 (SGM 221)**

**Module credits** 16.00

**Prerequisites** SGM 210 GS

**Contact time** 2 practicals per week, 2 lectures per week, 1 tutorial per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Civil Eng

**Period of presentation** Semester 2

**Module content**

Geological origin. Soil tests and classification systems. Compaction, stabilisation. Bitumen and tar. Introduction to pavements. Overview of road building materials. Pavement design principles and methods.

**Structural analysis 223 (SIN 223)**

**Module credits** 16.00

**Prerequisites** WTW 161, WTW 168 and SWK 210

**Contact time** 1 tutorial per week, 2 practicals per week, 3 lectures per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Civil Eng

**Period of presentation** Semester 2

**Module content**

Statically indeterminate beams. Euler buckling of columns with different boundary conditions. Virtual work. Analysis of statically indeterminate structures using the methods of super-position, slope-deflection and moment distribution (with sway and support displacement).

**Strength of materials 210 (SWK 210)**

**Module credits** 16.00

**Service modules** Faculty of Natural and Agricultural Sciences

**Prerequisites** Faculty of Engineering, Built Environment and Information Technology: SWK 122 and WTW 164 OR SWK 122, WTW 161 and WTW 168. Faculty of Natural and Agricultural Sciences: SWK 122 and WTW 124 OR SWK 122, WTW 126 and WTW 128.

**Contact time** 4 lectures per week, 2 tutorials per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Civil Eng

**Period of presentation** Semester 1

### Module content

Stresses, strains and the mechanical properties of materials: Normal stress and shear stress, tension and compression, equilibrium in shear, factor of safety, design, shear strain, stress/strain diagram, Hooke's Law, Poisson's Ratio and the shear stress/strain diagram. Axial loads: Elastic deformation, displacements, statically determinate and indeterminate structures and thermal effects. Torsion: Torsion of circular bars and power transmission bending of straight members and composite beams. Transverse shear: Shear in straight members and shear flow. Combined loads: Thin walled pressure vessels and stresses as a result of combined loads. Stress transformation: Plane stress transformation, principle stresses, maximum values and stress variation in prismatic beams. Strain transformation: Plane strain transformation, principle strains, maximum values, strain gauges and rosettes and the relationship between  $E$ ,  $G$  and  $\nu$ . Design of beams from section characteristics. Deflection of beams: The elastic curve, integration method, Macaulay's method and superposition.

## Mathematics 238 (WTW 238)

**Module credits** 16.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology

**Prerequisites** WTW 256 and WTW 258 GS

**Contact time** 4 lectures per week, 2 tutorials per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Mathematics and Applied Maths

**Period of presentation** Semester 2

### Module content

Linear algebra, eigenvalues and eigenvectors with applications to first and second order systems of differential equations. Sequences and series, convergence tests. Power series with applications to ordinary differential equations with variable coefficients. Fourier series with applications to partial differential equations such as potential, heat and wave equations.

## Differential equations 256 (WTW 256)

**Module credits** 8.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology

**Prerequisites** WTW 158 and WTW 164

**Contact time** 1 discussion class per week, 2 lectures per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Mathematics and Applied Maths

**Period of presentation** Semester 1

### Module content

Theory and solution methods for linear differential equations as well as for systems of linear differential equations. Theory and solution methods for first order non-linear differential equations. The Laplace transform with application to differential equations. Application of differential equations to modelling problems.

## Professional and technical communication 210 (SJJ 210)

**Module credits** 8.00

**Prerequisites** No prerequisites.

**Contact time** 2 other contact sessions per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Academic organisation** Civil Eng

**Period of presentation** Semester 1

### Module content

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

## Statics 211 (SWK 211)

**Module credits** 16.00

**Prerequisites** SWK 122

**Contact time** 3 tutorials per week, 2 lectures per week, 1 practical per week

**Language of tuition** Module is presented in English

**Academic organisation** Civil Eng

**Period of presentation** Semester 1

### Module content

Centroids: centroids of lines, surfaces and volumes. Constraints and statical determinacy. Space trusses. Bending moments and cables: distributed loads, parabolic and uniform cables. Liquid statics: buoyancy. Elasticity: stress-strain, stiffness, elastic moduli relations, torsion. Deflection of beams: derivation of differential equations, bending stresses. Friction: friction surfaces, wedges, screws, belt, bearings and rolling resistance. Work and energy, virtual work. Vibration.



## Curriculum: Year 4

Minimum credits: 154

### Core modules

#### Civil building materials 321 (SBM 321)

Module credits	16.00
Prerequisites	SGM 221
Contact time	2 practicals per week, 1 tutorial per week, 3 lectures per week
Language of tuition	Separate classes for Afrikaans and English
Academic organisation	Civil Eng
Period of presentation	Semester 2

##### Module content

The behaviour, properties and application of cement and concrete products, structural steel, fibre reinforcing, polymers, masonry work and bituminous materials.

#### Soil mechanics 311 (SGM 311)

Module credits	16.00
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	(SWK 210)
Contact time	3 lectures per week, 2 practicals per week, 1 tutorial per week
Language of tuition	Separate classes for Afrikaans and English
Academic organisation	Civil Eng
Period of presentation	Semester 1

##### Module content

Introduction to soil mechanics. Introduction to clay mineralogy. Mass, volume relationships and phases of soil. Groundwater flow and permeability. Effective stress principles. Suction pressures in saturated as well as partially saturated soil. The Mohr circle and stresses at a point. The Mohr-Coulomb strength theory and the stress-strain properties of soil. The Boussinesq theory. Consolidation theory and soil settlement.

#### Geotechnical engineering 323 (SGM 323)

Module credits	16.00
Prerequisites	(SGM 311)
Contact time	1 practical per week, 3 lectures per week, 2 discussion classes per week
Language of tuition	Separate classes for Afrikaans and English
Academic organisation	Civil Eng
Period of presentation	Semester 2

## Module content

Application of consolidation theory. Bearing capacity of soil and foundation design, Terzaghi and general methods. Horizontal stresses in soil and design of retaining structures, Rankine and Couloumb's methods. Slope stability including Bishop's method of slices. Introduction to site investigation.

## Hydraulics 310 (SHC 310)

**Module credits** 16.00

**Prerequisites** (SWK 210)

**Contact time** 1 discussion class per week, 1 practical per week, 4 lectures per week

**Language of tuition** Afrikaans and English is used in one class

**Academic organisation** Civil Eng

**Period of presentation** Semester 1

## Module content

Fluid properties and fundamental principles of applied hydrostatic, hydrostatic forces on bodies, buoyancy and stability of bodies. Kinematics, flow rate measurement and velocity determination. Pipe flow and real fluids. Basic principles of water purification and water treatment.

## Timber design 310 (SIB 310)

**Module credits** 8.00

**Prerequisites** SIN 223 GS

**Contact time** 1 tutorial per week, 2 lectures per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Civil Eng

**Period of presentation** Semester 1

## Module content

Self-weight, imposed and wind loads. Principles of limit-states design. Timber as a structural material, design of tension, compression and bending members (laterally braced and unbraced), beam columns, trusses and bracing.

## Structural analysis 311 (SIN 311)

**Module credits** 8.00

**Prerequisites** SIN 223

**Contact time** 1 tutorial per week, 1 practical per week, 2 lectures per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Civil Eng

**Period of presentation** Semester 1

### Module content

Analysis of symmetrical structures using slope-deflection equations or moment-distribution; three dimensional structures and grillages; plastic analysis of frames; matrix methods; influence lines.

## Transportation engineering 323 (SVC 323)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	BES 220
<b>Contact time</b>	4 lectures per week, 2 tutorials per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Civil Eng
<b>Period of presentation</b>	Semester 2

### Module content

Introduction to transportation engineering; vehicle performance and motion; traffic analysis techniques; traffic data collection; capacity and level of service analysis; railway engineering; airport capacity; geometric road design; cross-section, horizontal and vertical alignment; urban streets; layout considerations and intersection design; traffic control; traffic safety.

## Hydraulics 321 (SHC 321)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	(SHC 310)
<b>Contact time</b>	1 practical per week, 4 lectures per week, 1 tutorial per week
<b>Language of tuition</b>	Afrikaans and English is used in one class
<b>Academic organisation</b>	Civil Eng
<b>Period of presentation</b>	Semester 2

### Module content

Pipe network analyses and municipal services. Components of water distribution networks. Pump selection and water hammer analyses. Free surface flows and model analyses.

## Programming and information technology 213 (MPR 213)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 practicals per week, 4 lectures per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Mechanical and Aeronautical En
<b>Period of presentation</b>	Semester 1

## Module content

Advanced spreadsheet applications: Named ranges, linear algebra, solution of systems of equations, regression, interpolation, optimisation and table manipulation. Basic structured programming: Looping, branching, subroutines, iteration, reading and writing data files. Development, coding and debugging of simple programs in a high level programming language. Programming principles are illustrated via mathematical concepts such as limits, differentiation, integration and linear algebra. Structured programming by making use of functions and available toolboxes. Basic graphical output (plotting is also covered). Different information resources, searching and management of information. Use of databases. Development of webpages. Hardware interaction and control of equipment and systems.

## Civil engineering economics 310 (SIE 310)

<b>Module credits</b>	8.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week, 2 other contact sessions per week
<b>Language of tuition</b>	Module is presented in English
<b>Academic organisation</b>	Civil Eng
<b>Period of presentation</b>	Semester 1

## Module content

Introduction to engineering economics: Basic guidelines, assessment of alternative investment possibilities. Equal annual cash flow, current value, internal rate of return, cost benefit relationship. Economic evaluation of projects: Influence of depreciation on the economics of projects, determination of income tax implications of decisions, economic analysis of multiple alternatives, the influence of inflation on the economics of projects, application of the theory of probability for economics studies, economic studies on the replacement of equipment.

## Structural concrete 325 (SIN 325)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	SIN 223
<b>Contact time</b>	1 tutorial per week, 1 practical per week, 4 lectures per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Civil Eng
<b>Period of presentation</b>	Semester 2

## Module content

Properties of reinforced concrete. Principles of limit states design. Analysis and design of sections in flexure and in compression combined with flexure. Design for shear and torsion. Bond and anchorage. Serviceability requirements: Detailing and span-effective depth ratios. Design of footings and short columns.

Behaviour and design of beams, slabs (solid, ribbed and waffle slabs, flat plates and flat slabs), columns (slender columns and biaxial bending), footings (simple and combined footings) and stairs. Introduction to the design of prestressed concrete flexural members.

## Curriculum: Final year

**Minimum credits: 158**

### Core modules

#### Civil engineering construction management 420 (SBZ 420)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	(SVC 412)
<b>Contact time</b>	1 practical per week, 4 lectures per week, 1 tutorial per week
<b>Language of tuition</b>	Module is presented in English
<b>Academic organisation</b>	Civil Eng
<b>Period of presentation</b>	Semester 2

##### Module content

Planning, needs assessment and performance indicators for contracts. Civil Engineering Project: client, consultant and contractors expectations and responsibilities. Tender process, construction process, application of OHS Act and Mine, Health and Safety Act, conditions of contract and claims, insurances, engineering economics, programming, costing, 1509001: quality management systems, life cycle concepts, maintenance cycle, maintenance management.

#### Detailed design 420 (SDO 420)

<b>Module credits</b>	24.00
<b>Prerequisites</b>	(SHC 410), (SIN 411), (SIN 413), (SGM 323), (SVC 412)
<b>Contact time</b>	5 lectures per week, 1 tutorial per week, 1 practical per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Academic organisation</b>	Civil Eng
<b>Period of presentation</b>	Semester 2

##### Module content

The module focuses on design applications. The student is exposed to the application of the classic disciplines of structures, geotechnical, hydraulics and transportation in detail design. Supervisors select the most valuable application in each discipline. Typical examples include the following:

- Structures: Multi storey buildings with reinforced concrete frames and slabs
- Hydraulics: Pump lines and stations
- Geotechnical: Slimes dams
- Transportation: Traffic impact studies, pavement design and analysis

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

#### Environmental geotechnology 421 (SEV 421)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	No prerequisites.



**Contact time** 1 practical per week, 1 tutorial per week, 4 lectures per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Civil Eng

**Period of presentation** Semester 2

#### Module content

Regulatory framework, site investigation, site restoration, and waste disposal. Site characterization methods. Waste types and properties. Subsurface contaminant transport. Multiphase fluid flow. Design of waste containment and waste disposal systems. Review of remedial alternatives with emphasis on in situ technologies. Case histories. Integrated environmental management processes. Environmental legislation in South Africa. Environmental impact, environmental auditing and risk analysis. ISO 140000: what it entails and how it is applied. Community participation.

### Hydraulics 410 (SHC 410)

**Module credits** 16.00

**Prerequisites** (SHC 310), SHC 321GS

**Contact time** 4 lectures per week, 1 tutorial per week, 1 practical per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Civil Eng

**Period of presentation** Semester 1

#### Module content

Sediment transportation, hydraulic structures, bridges and culvert hydraulics, stormwater handling. Hydrology, flood hydrology, creation of runoff records and the simulation of surface water resources, creation of stochastic sequences and the reliability analysis of surface water resources.

### Steel design 411 (SIN 411)

**Module credits** 8.00

**Prerequisites** (SIN 323)

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Civil Eng

**Period of presentation** Semester 1

#### Module content

Analysis and design composite steel beam and concrete slab construction, Moment connections, Elastic and plastic design of portal, industrial and building structures.

### Reinforced concrete design 413 (SIN 413)

**Module credits** 8.00

**Prerequisites** (SIN 324)

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Civil Eng

**Period of presentation** Semester 1

**Module content**

Behaviour and design of beams, slabs (solid, ribbed and waffle slabs, flat plates and flat slabs), columns (slender columns and biaxial bending), footings (simple and combined footings) and stairs. Introduction to the design of prestressed concrete flexural members.

**Practical training 410 (SPY 410)**

**Module credits** 16.00

**Prerequisites** No prerequisites.

**Contact time** 1 other contact session per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Civil Eng

**Period of presentation** Semester 1

**Module content**

\*Attendance module only

During or at the end of the third year of study, students in civil engineering undergo at least 6 weeks of prescribed training in the industry. A satisfactory report on the practical training must be submitted to the Student Administration within one week of registration.

**Research project 412 (SSC 412)**

**Module credits** 30.00

**Prerequisites** (SHC 321) (SIN 323) (SIN 324) (SGM 323) (SBM 321) (SVC 323)

**Contact time** 2 tutorials per week, 6 practicals per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Civil Eng

**Period of presentation** Semester 1

**Module content**

In the first semester, two full days of the week must be used by final-year students for the execution of an analytical and/or experimental research project.

**Infrastructure planning 412 (SVC 412)**

**Module credits** 16.00

**Prerequisites** (SIE 310/BIE 310) (SVC 323)

**Contact time** 4 lectures per week, 2 practicals per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Civil Eng

**Period of presentation** Semester 1

### Module content

Introduction to the basic concepts of urban and regional planning. The planning process, policy and institutional framework in which planning functions in SA. The interaction and co-operation of land and space, economy, politics and social aspects related to space in decision making. Interventions for sustainable development planning and design; definitions and rationale for land-use management and the strategic integrated development planning process. Infrastructure system evaluation, risk assessment, feasibility and decision analysis. Life cycle costing of infrastructure. Demand and supply analysis. Demand forecasting models.

## Engineering professionalism 410 (IPI 410)

**Module credits** 8.00

**Prerequisites** No prerequisites.

**Contact time** 2 lectures per week, 1 other contact session per week

**Language of tuition** Module is presented in English

**Academic organisation** Engineering and Technology Mgt

**Period of presentation** Semester 1

### Module content

Requirements to maintain continued competence and to keep abreast of up-to date tools and techniques. ECSA code of conduct, Continuing Professional Development, ECSA outcomes, ECSA process and reasons for registration as CEng and PrEng. Displays understanding of the system of professional development. Accepts responsibility for own actions. Displays judgment in decision making during problem solving and design. Limits decision making to area of current competence. Reason about and make judgment on ethical aspects in case study context. Discerns boundaries of competence in problem solving and design. Case studies typical of engineering practice situations in which the graduate is likely to participate.

## Computer applications in civil engineering 420 (SCA 420)

**Module credits** 16.00

**Prerequisites** (SHC 410), (SIN 411), (SIN 413), (SGM 323), (SVC 412)

**Contact time** 2 practicals per week, 3 lectures per week, 2 tutorials per week

**Language of tuition** Separate classes for Afrikaans and English

**Academic organisation** Civil Eng

**Period of presentation** Semester 2

### Module content

In this module commercially available computer packages will be used to develop models based on Finite Elements, Finite Differences and other approaches. Limitations and simple checks to ensure consistency of commonly used design software packages will be illustrated. Basic principles and techniques will be discussed and the effect of aspects such as meshing, element choice, boundary conditions and material properties will be investigated. Applications within the various fields of Civil Engineering will be considered. Results obtained from models will be compared to actual experimental results. This module will contain groupwork and multi-disciplinary problems will be solved.

The information published here is subject to change and may be amended after the publication of this information. The [General Regulations \(G Regulations\)](#) apply to all faculties of the University of Pretoria. It is expected of students to familiarise themselves well with these regulations as well as with the information contained in the [General Rules](#) section. Ignorance concerning these regulations and rules will not be accepted as an excuse for any transgression.