BEng Mechanical Engineering (12130051)

Duration of study  
4 years

Total credits  
578

Programme information

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

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


b. Application of specialist and fundamental knowledge, with specific reference to mathematics, basic sciences and engineering sciences.

c. Engineering design and synthesis.

d. Investigation, experimentation and data analysis.

e. Engineering methods, skills, tools and information technology.

f. Professional and general communication.

g. Awareness and knowledge of the impact of engineering activity on society and the physical environment.

h. Work in teams and in multidisciplinary environments.

i. An awareness and ability for lifelong learning.

j. An awareness and knowledge of principles of professional ethics and practice.

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

Knowledge areas:

a. Mathematics, including numerical methods and statistics (13%)

b. Basic sciences: the natural sciences essential to the programme (15%)

c. Engineering sciences (40%)

d. Engineering design and synthesis (16%)

e. Computing and information technology (5%)

f. Complementary studies: communication, economy, management, innovation, environmental impact, ethics, engineering practice (11%).
Admission requirements

- In order to register NSC/IEB/Cambridge candidates must comply with the minimum requirements for degree studies as well as with the minimum requirements for the relevant study programme.
- Life Orientation is excluded when calculating the APS. Grade 11 results are used in the provisional admission of prospective students.
- Grade 11 results are used in the provisional admission of prospective students.
- A valid National Senior Certificate (NSC) with admission to degree studies is required.
- Minimum subject and achievement requirements, as set out below, are required. On first-year level a student has a choice between Afrikaans and English as language medium.
- In certain cases, tuition may be presented in English only, for example in electives, where the lecturer may not speak Afrikaans or in cases where it is not economically or practically viable.
- Provisional admission to the four-year programme in the School of Engineering is only guaranteed if a prospective student complies with ALL the requirements below.

Note

Candidates who do not comply with the minimum requirements, set out above, but who have obtained a minimum APS of 30, an achievement level of 5 for English or Afrikaans, 6 for Mathematics and 5 for Physical Science, will be considered for provisional admission to either the four-year programme or the ENGAGE programme based on the results of the compulsory NBT.

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

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

Minimum requirements for 2016

<table>
<thead>
<tr>
<th>Achievement level</th>
<th>Afrikaans or Engels</th>
<th>Mathematics</th>
<th>Physical Science</th>
<th>APS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSC/IEB</td>
<td>HIGCSE</td>
<td>AS-Level</td>
<td>A-Level</td>
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</tr>
<tr>
<td>5</td>
<td>3</td>
<td>C</td>
<td>C</td>
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</tr>
<tr>
<td>6</td>
<td>2</td>
<td>B</td>
<td>B*</td>
<td>35</td>
</tr>
</tbody>
</table>

* A-Level: C-simbool vir Wiskunde Fisika en Chemie sal oorweeg word vir toelating op voorwaarde dat die vereiste TPT behaal is.

Other programme-specific information

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

With a few exceptions, most modules offered at the School of Engineering are semester modules having credit values of either 8 or 16.

A student may be permitted by the Dean, on recommendation of the relevant head of the department, to register for an equivalent module in an alternate semester, although the module is normally offered to the student’s group in another semester, and providing that no timetable clashes occur.
Please note:

1. Students who did not pass SWK 122 Mechanics 122 in their first year of study can take the module in the first semester of the following year.

2. All students are required to successfully complete JCP 2013, Community-based project 203 as part of the requirements for the BEng degree. A student may register for the module during any of the years of study of the programme, but preferably not during the first or the final year of study.

3. Students registered for Chemical Engineering who have passed CBI 311, receive credit for CBI 410.

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

5. Offering of electives depends on the availability of resources and industry support.

Promotion to next study year

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

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

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

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

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

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

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

Please note:

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

ii. Students who intend transferring to Mining Engineering, must familiarise themselves with the stipulations set
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: 144

Fundamental modules

Academic orientation 112 (UPO 112)

Module credits: 0.00
Language of tuition: Double Medium
Academic organisation: EBIT Dean's Office
Period of presentation: Year

Core modules

General chemistry 172 (CHM 172)

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.

Module credits: 16.00
Service modules: Faculty of Engineering, Built Environment and Information Technology
Prerequisites: No prerequisites.
Contact time: 1 practical per week, 1 web-based period per week, 4 lectures per week, 1 discussion class per week
Language of tuition: Both Afr and Eng
Academic organisation: Chemistry
Period of presentation: Semester 2

Electricity and electronics 111 (EBN 111)

Module content:
Electrical quantities, units, definitions, conventions. Electrical symbols, ideal and practical current and voltage sources, controlled sources. Ohm’s law in resistive circuits, Kirchhoff’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.
**Physics 116 (FSK 116)**

**Module content:**

<table>
<thead>
<tr>
<th>Module credits</th>
<th>16.00</th>
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<tbody>
<tr>
<td>Service modules</td>
<td>Faculty of Engineering, Built Environment and Information Technology</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>No prerequisites.</td>
</tr>
<tr>
<td>Contact time</td>
<td>1 discussion class per week, 4 lectures per week, 1 practical per week</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>Both Afr and Eng</td>
</tr>
<tr>
<td>Academic organisation</td>
<td>Physics</td>
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<tr>
<td>Period of presentation</td>
<td>Semester 1</td>
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</tbody>
</table>

**Graphical communication 110 (MGC 110)**

**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.

<table>
<thead>
<tr>
<th>Module credits</th>
<th>16.00</th>
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<tbody>
<tr>
<td>Service modules</td>
<td>Faculty of Education</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>No prerequisites.</td>
</tr>
</tbody>
</table>
### Materials science 123 (NMC 123)

**Module content:**

**Module credits**
16.00

**Prerequisites**
No prerequisites.

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

**Language of tuition**
Both Afr and Eng

**Academic organisation**
Materials Science and Metallurgy

**Period of presentation**
Semester 2

### Mechanics 122 (SWK 122)

**Module content:**

**Module credits**
16.00

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

**Prerequisites**
WTW 158

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

**Language of tuition**
Both Afr and Eng

**Academic organisation**
Civil Eng
Period of presentation  Semester 1 or Semester 2

Calculus 158 (WTW 158)

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.

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

Workshop practice 121 (WWP 121)

Module content:
*Attendance module only
The module is offered at the end of the first year of study and lasts at least eight days, during which training is given in the following workshops: electronic projects, panel wiring, electrical motors and switch gear, general machines, welding, turning and sheet metal work. Each student's progress is assessed after each workshop.

Module credits  6.00
Prerequisites  No prerequisites.
Contact time  1 other contact session per week
Language of tuition  Both Afr and Eng
Academic organisation  Mechanical and Aeronautical En
Period of presentation  Semester 2

Humanities and social sciences 110 (HAS 110)

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.

**Module credits** 8.00

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

**Prerequisites** No prerequisites.

**Contact time** 2 lectures per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Anthropology and Archaeology

**Period of presentation** Semester 1

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

**Module content:**

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.

**Module credits** 8.00

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

**Prerequisites** No prerequisites.

**Contact time** 2 lectures per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Afrikaans

**Period of presentation** Semester 2

**Mathematics 164 (WTW 164)**

**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,

<table>
<thead>
<tr>
<th>Module credits</th>
<th>16.00</th>
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<tbody>
<tr>
<td>Prerequisites</td>
<td>WTW 114 GS or WTW 158 GS</td>
</tr>
<tr>
<td>Contact time</td>
<td>4 lectures per week, 1 tutorial per week</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>Both Afr and Eng</td>
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<tr>
<td>Academic organisation</td>
<td>Mathematics and Applied Maths</td>
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<tr>
<td>Period of presentation</td>
<td>Semester 2</td>
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</tbody>
</table>
Curriculum: Year 2

Minimum credits: 146

Core modules

Engineering statistics 220 (BES 220)

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.

| Module credits | 8.00 |
| Prerequisites   | No prerequisites. |
| Contact time    | 1 tutorial per week, 2 lectures per week |
| Language of tuition | Both Afr and Eng |
| Academic organisation | Industrial and Systems Eng |
| Period of presentation | Semester 2 |

Community-based project 203 (JCP 203)

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.

| Module credits | 8.00 |
| Prerequisites   | No prerequisites. |
| Contact time    | 1 lecture per week |
| Language of tuition | Both Afr and Eng |
| Academic organisation | Informatics |
| Period of presentation | Year |

Manufacturing and design 217 (MOW 217)

Module content:
Detailed exposure to manufacturing processes including heat treatment. Detailed exposure to machine elements. Conceptual framework for design process including life cycle, ergonomics, material selection, manufacturing and safety factor considerations.
### Structural design 227 (MOW 227)

**Module content:**
Analyse statistically determinate structures to obtain section forces and moments and stress distributions. Thin-walled pressure vessels. Stress and strain transformations. Introduction of stress tensor. Derivation of stress transformation equations. Eigenvalue/vector analysis for principle stresses and strains. Mohr’s circle. Failure criteria. Fatigue strength design. All analysis techniques above are applied to the open-ended design of components like beams and shafts.

<table>
<thead>
<tr>
<th>Module credits</th>
<th>16.00</th>
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<tbody>
<tr>
<td>Prerequisites</td>
<td>MGC 110</td>
</tr>
<tr>
<td>Contact time</td>
<td>3 lectures per week, 4 tutorials per week</td>
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<tr>
<td>Language of tuition</td>
<td>Both Afr and Eng</td>
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<tr>
<td>Academic organisation</td>
<td>Mechanical and Aeronautical En</td>
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<tr>
<td>Period of presentation</td>
<td>Semester 1</td>
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### Dynamics 210 (MSD 210)

**Module content:**

<table>
<thead>
<tr>
<th>Module credits</th>
<th>16.00</th>
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<tbody>
<tr>
<td>Prerequisites</td>
<td>SWK 122</td>
</tr>
<tr>
<td>Contact time</td>
<td>4 tutorials per week, 3 lectures per week</td>
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<tr>
<td>Language of tuition</td>
<td>Both Afr and Eng</td>
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<tr>
<td>Academic organisation</td>
<td>Mechanical and Aeronautical En</td>
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<tr>
<td>Period of presentation</td>
<td>Semester 2</td>
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</tbody>
</table>
Thermodynamics 221 (MTX 221)

Module content:

Module credits 16.00

Prerequisites FSK 116 or FSK 176

Contact time 1 tutorial per week, 1 practical per week, 3 lectures per week

Language of tuition Double Medium

Academic organisation Mechanical and Aeronautical En

Period of presentation Semester 2

Mathematics 238 (WTW 238)

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.

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 Both Afr and Eng

Academic organisation Mathematics and Applied Maths

Period of presentation Semester 2

Differential equations 256 (WTW 256)

Module content:

Module credits 8.00

Service modules Faculty of Engineering, Built Environment and Information Technology
### Prerequisites
- WTW 158 and WTW 164

### Contact time
- 2 lectures per week, 1 discussion class per week

### Language of tuition
- Both Afr and Eng

### Academic organisation
- Mathematics and Applied Maths

### Period of presentation
- Semester 1

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**Calculus 258 (WTW 258)**

**Module content:**

<table>
<thead>
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<th>Module credits</th>
<th>8.00</th>
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<tr>
<td>Service modules</td>
<td>Faculty of Engineering, Built Environment and Information Technology</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>WTW 158 and WTW 164</td>
</tr>
<tr>
<td>Contact time</td>
<td>2 lectures per week, 1 tutorial per week</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>Both Afr and Eng</td>
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<tr>
<td>Academic organisation</td>
<td>Mathematics and Applied Maths</td>
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<tr>
<td>Period of presentation</td>
<td>Semester 1</td>
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**Numerical methods 263 (WTW 263)**

**Module content:**

<table>
<thead>
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<th>Module credits</th>
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<tr>
<td>Service modules</td>
<td>Faculty of Engineering, Built Environment and Information Technology</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>WTW 164</td>
</tr>
<tr>
<td>Contact time</td>
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<tr>
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<tr>
<td>Period of presentation</td>
<td>Semester 2</td>
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**Professional and technical communication 210 (MJJ 210)**

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

**Module credits** 8.00

**Prerequisites** No prerequisites.

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

**Language of tuition** English

**Academic organisation** Mechanical and Aeronautical En

**Period of presentation** Semester 1

### Programming and information technology 213 (MPR 213)

**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.

**Module credits** 18.00

**Prerequisites** No prerequisites.

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

**Language of tuition** Both Afr and Eng

**Academic organisation** Mechanical and Aeronautical En

**Period of presentation** Semester 1
Curriculum: Year 3

Minimum credits: 144

Core modules

**Electrical engineering 221 (EIR 221)**

**Module content:**

<table>
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<th>Module credits</th>
<th>16.00</th>
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<tbody>
<tr>
<td>Prerequisites</td>
<td>EBN 111 or EBN 122 and WTW 161</td>
</tr>
<tr>
<td>Contact time</td>
<td>1 tutorial per week, 1 practical per week, 3 lectures per week</td>
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<td>Language of tuition</td>
<td>Both Afr and Eng</td>
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<tr>
<td>Academic organisation</td>
<td>Electrical, Electronic and Com</td>
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<tr>
<td>Period of presentation</td>
<td>Semester 2</td>
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</table>

**Machine design 312 (MOW 312)**

**Module content:**
Open-ended subsystem design using the following elements: Beams, shafts, bolts, bearings, rivets, welds, springs, couplings, clutches, brakes, gears and gear systems. Static and fatigue design fundamentals. Code design: Pressure vessels, structural steel design, hoisting systems and ropes, welding SANS code.

<table>
<thead>
<tr>
<th>Module credits</th>
<th>16.00</th>
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<tbody>
<tr>
<td>Prerequisites</td>
<td>MOW 217, (MOW 227)</td>
</tr>
<tr>
<td>Contact time</td>
<td>3 tutorials per week, 3 lectures per week</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
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<td>Academic organisation</td>
<td>Mechanical and Aeronautical En</td>
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<tr>
<td>Period of presentation</td>
<td>Semester 1</td>
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</tbody>
</table>

**Simulation-based design 323 (MOW 323)**

**Module content:**
Computational dynamics analysis of mechanisms, linkages and cams. Structural computational analysis using
finite element software. Systems engineering and functional analysis. Open-ended multidisciplinary design and design improvement of products and systems.

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<tr>
<th><strong>Module credits</strong></th>
<th>16.00</th>
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<tbody>
<tr>
<td><strong>Prerequisites</strong></td>
<td>(MSD 210), MOW 227</td>
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<tr>
<td><strong>Contact time</strong></td>
<td>3 lectures per week, 5 tutorials per week</td>
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<td><strong>Academic organisation</strong></td>
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<tr>
<td><strong>Period of presentation</strong></td>
<td>Semester 2</td>
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</tbody>
</table>

**Practical training 315 (MPY 315)**

**Module content:**
Prescribed practical training in industry during or at end of second year. Aim is exposure to engineering equipment and processes, working environment of craftsmen and personnel relations. Duration at least six weeks. Perform case study on personnel management and submit together with a satisfactory report on the practical training, to the Faculty Administration within one week of registration. Attend two (2) industry visits in the first semester and two (2) industry visits in the second semester. Attend at least six (6) guest lectures through the year.

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<tr>
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<tr>
<td><strong>Prerequisites</strong></td>
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<tr>
<td><strong>Contact time</strong></td>
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<td><strong>Language of tuition</strong></td>
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**Structural mechanics 310 (MSY 310)**

**Module content:**

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<tr>
<td><strong>Prerequisites</strong></td>
<td>MOW 227, WTW 256</td>
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<tr>
<td><strong>Contact time</strong></td>
<td>1 practical per week, 3 lectures per week</td>
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<td><strong>Language of tuition</strong></td>
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</table>
**Period of presentation** Semester 1

**Vibration and noise 320 (MVR 320)**

**Module content:**

**Module credits** 16.00

**Prerequisites** (MSD 210)

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

**Language of tuition** English

**Academic organisation** Mechanical and Aeronautical En

**Period of presentation** Semester 2

**Thermofluids 310 (MTV 310)**

**Module content:**

**Module credits** 16.00

**Prerequisites** No prerequisites.

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

**Language of tuition** English

**Academic organisation** Mechanical and Aeronautical En

**Period of presentation** Semester 1

**Thermodynamics 311 (MTX 311)**

**Module content:**
Third Law of Thermodynamics, availability and useful work. Ideal and real gases. Compressible flow: conservation laws, characteristics of compressible flow, normal shock waves, nozzles and diffusers. Power cycles: classification, internal combustion engine cycles (Otto and Diesel), vapour power cycles (Brayton, Rankine),

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<tr>
<td>Prerequisites</td>
<td>MTX 221</td>
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<tr>
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</table>

**Engineering management 310 (BSS 310)**

**Module content:**
Programme and systems engineering Concepts: Application of project management, systems thinking, systems approach, product, system and project life cycles, project phases and specification practices. Development models: stage-gate development, project charter, systems engineering models, systems engineering management and life cycle characteristics. Planning and Scheduling: task definition, work breakdown structures, duration estimation, Gantt charts, critical path, resource handling. Costs and Budgets: cost estimates, project life cycle costs, work authorisation. Control: project organisation. Legal: contracts, intellectual property. Case studies and semester project Engineering Economics Decision making in an engineering environment. Allocation of cost. Money-time relationships (discreet interest formulae, tables, financial calculator, Excel). Bases for comparison of alternatives (present worth, annual worth,). Decision making among alternatives before and after tax (useful lives equal to study period, useful lives different among alternatives).

<table>
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<tr>
<th>Module credits</th>
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<tr>
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<td>Academic organisation</td>
<td>Industrial and Systems Eng</td>
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<td>Semester 1</td>
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**Engineering activity and group work 320 (MIA 320)**

**Module content:**
Two exit learning outcomes (ELO) of ECSA are addressed and each must be passed in the same semester. ELO7: Demonstrate critical awareness of the impact of engineering activity on the social, industrial and physical environment. The history of engineering globally and in South Africa. Most important engineering projects globally and in South Africa. The impact of technology on society. Occupational and public health and safety. Occupational Health and Safety Act. Impacts on the physical environment. The personal, social, cultural values
and requirements of those affected by engineering activity. The combination of social, workplace (industrial) and physical environmental factors are appropriate to the discipline of the qualification. ELO8: Demonstrate competence to work effectively on a small project as an individual, in teams and in multidisciplinary environments. Identifies and focuses on objectives. Works strategically. Executes tasks effectively. Delivers completed work on time. Effective team work: Makes individual contribution to team activity; performs critical functions; enhances work of fellow team members; benefits from support of team members; communicates effectively with team members; delivers completed work on time. Multidisciplinary work by the following: Acquires a working knowledge of co-workers’ discipline; uses a systems engineering approach; communicates across disciplinary boundaries. Report and presentation on team project. Tasks require co-operation across at least one disciplinary boundary. Students acquire a working knowledge of co-workers discipline. Students communicate between disciplinary boundaries.

Module credits 8.00
Prerequisites No prerequisites.
Contact time 1 other contact session per week, 2 lectures per week
Language of tuition English
Academic organisation Mechanical and Aeronautical En
Period of presentation Semester 2

Solid mechanics 321 (MKM 321)

Module content:

Module credits 16.00
Prerequisites MOW 227
Contact time 1 practical per week, 3 lectures per week
Language of tuition English
Academic organisation Mechanical and Aeronautical En
Period of presentation Semester 2
Curriculum: Final year

Minimum credits: 144

Core modules

Control systems 410 (MBB 410)

Module content:

Module credits: 16.00
Prerequisites: MVR 320 GS
Contact time: 2 practicals per week, 3 lectures per week
Language of tuition: English
Academic organisation: Mechanical and Aeronautical En
Period of presentation: Semester 2

Design project 410 (MOX 410)

Module content:
A comprehensive design in order to cover all the design aspects of functionality, analysis, ability to integrate, manufacturability and maintainability. Cost and reliability are included as inclusive factors.

Module credits: 16.00
Prerequisites: MOW 312 GS and MOW 323 GS
Contact time: 8 tutorials per week
Language of tuition: Both Afr and Eng
Academic organisation: Mechanical and Aeronautical En
Period of presentation: Semester 1

Practical training 415 (MPY 415)

Module content:
During or at the end of the third year of study, students in Mechanical Engineering undergo prescribed practical training in the industry. The purpose is the execution of small projects on engineering assistant level with exposure to the various relevant functions in the organisation. The duration is at least six weeks. A case study on occupational health and safety must be done in this period and submitted to the department together with a satisfactory report on the practical training within one week of registration. Students must also attend two (2) industry visits in the first semester and two (2)
industry visits in the second semester as well as attend at least six (6) guest lectures through the year.

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<tbody>
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<td>Mechanical and Aeronautical En</td>
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<td>Period of presentation</td>
<td>Semester 1</td>
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**Thermal and fluid machines 420 (MTV 420)**

**Module content:**

(i) Thermodynamics: Introductory thermodynamics with reference to power cycles. Energy systems and views, transformation of energy. Nuclear power.


(iv) Steam engines: Turbo machine theory; types of turbines – properties and uses. Blades, rotors, sealing, balancing. Parallel operation of turbo generators in a power network.

(v) Internal combustion engines: Spark ignition and compression ignition. Applications.

(i) Classification: kinetic and positive displacement pumps and compressors. Incompressible and compressible flow. Pump, compressor and fan theory.

(ii) Equipment: functioning, properties, characteristics and use of well-known pumps and compressors.


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<td>Prerequisites</td>
<td>MTV 310, (MTX 311)</td>
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<tr>
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<td>Period of presentation</td>
<td>Semester 1 or Semester 2</td>
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**Research project 412 (MSC 412)**

**Module content:**

The module involves the management of the execution of a project that produces knowledge and understanding of a phenomenon, conclusions and a recommended course of action. The project is undertaken under the supervision of a staff member with the student ultimately taking responsibility for the management of and
The student should be able to demonstrate competence in designing and conducting investigations and experiments and adherence to well defined time-lines and work breakdown structures. An acceptable process consists of but is not restricted to: (a) planning and conducting of investigations and experiments; (b) conducting of a literature search and critically evaluating material. The student should be able to demonstrate competence in engaging in independent learning through well-developed skills by: (a) reflecting on own learning and determining learning requirements and strategies; (b) sourcing and evaluating information; (c) determining learning requirements and strategies; (d) accessing, comprehending and applying knowledge acquired outside formal instruction; (e) critically challenging assumptions and embracing new thinking as well as communicating progress on a regular basis.

### Research project 422 (MSC 422)

**Module content:**

The module involves the management of the execution of a project that produces knowledge and understanding of a phenomenon, conclusions and a recommended course of action. The project is undertaken under the supervision of a staff member with the student ultimately taking responsibility for the management of and execution of the project. This module follows onto MSC412 and deals with the same topic in the same year. The student should be able to demonstrate competence in designing and conducting investigations and experiments and adherence to well defined time-lines and work breakdown structures. An acceptable process consists of but is not restricted to: (a) understanding of the stated problem, (b) developing a work breakdown structure, (c) performing the necessary analyses; (d) selecting and using appropriate equipment or software; (e) construction and instrumentation of an experimental set-up; (f) taking measurements; (g) analysing, interpreting and deriving information from data; (h) drawing conclusions based on evidence; (i) communicating the purpose, process and outcomes in a technical report, presentation and poster.

### Thermofluids 410 (MTV 410)

**Module content:**

Navier-Stokes and continuity equations. Euler equations, momentum equations. Conduction in two dimensions. Similarity and dimensional analysis. Convective heat transfer: forced convection (external and internal), natural
counterflow heat exchangers; double-pass, multi-pass and cross-flow heat exchangers; LMTD method,
Effectiveness-NTU method, selection of heat exchangers. Experimental techniques in heat transfer.

| Module credits | 16.00 |
| Prerequisites | No prerequisites. |
| Contact time | 1 practical per week, 3 lectures per week |
| Language of tuition | English |
| Academic organisation | Mechanical and Aeronautical En |
| Period of presentation | Semester 1 |

**Engineering professionalism 410 (IPI 410)**

**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.

| Module credits | 8.00 |
| Prerequisites | No prerequisites. |
| Contact time | 2 lectures per week, 1 other contact session per week |
| Language of tuition | English |
| Academic organisation | Engineering and Tech Man |
| Period of presentation | Semester 1 |

**Computational fluid dynamics 411 (MKM 411)**

**Module content:**
Introduction to continuum mechanics, continuity equation, momentum equation, Navier-Stokes equation, energy
equation, boundary conditions in thermal fluid systems, finite difference method, introduction to finite volume
method (FVM), FVM for diffusion problems, FVM for convection-diffusion problems, introduction to pressure-
velocity coupling in FVM. SIMPLE algorithm, selecting and assessing the applicability and limitations of the
method, properly applying the method with commercial software, critically testing and assessing the end-results.

| Module credits | 16.00 |
| Prerequisites | MTV 310 |
Contact time: 3 lectures per week, 1 practical per week

Language of tuition: English

Academic organisation: Mechanical and Aeronautical En

Period of presentation: Semester 1

Elective modules

**Maintenance engineering 420 (MII 420)**

**Module content:**

**Module credits**: 16.00

**Prerequisites**: No prerequisites.

**Contact time**: 1 practical per week, 3 lectures per week

**Language of tuition**: Both Afr and Eng

**Academic organisation**: Mechanical and Aeronautical En

**Period of presentation**: Semester 2

**Nuclear engineering 420 (MKI 420)**

**Module content:**

**Module credits**: 16.00

**Prerequisites**: No prerequisites.

**Contact time**: 1 practical per week, 1 discussion class per week, 3 lectures per week

**Language of tuition**: English

**Academic organisation**: Mechanical and Aeronautical En
**Aeronautics 420 (MLV 420)**

**Module content:**

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<th>Module credits</th>
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<tr>
<td>Prerequisites</td>
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**Vehicle engineering 420 (MVE 420)**

**Module content:**

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**Porous flow 420 (MAN 420)**

**Module content:**
Flow through porous media is relevant to applications such as internal combustion engines, thermal insulation engineering, electronics cooling, filtration, water movement in geothermal reservoirs, heat pipes, underground...
spreading of chemical waste, nuclear waste repository, geothermal engineering, grain storage, enhanced recovery of petroleum reservoirs and biological science. Introduction to the physical models used in the study of fluid flow and heat transfer in porous materials. Understanding of the transport mechanisms.

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**Mechatronics 421 (MEG 421)**

**Module content:**

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**Heat and mass transfer 420 (MHM 420)**

**Module content:**

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</table>
Optimum design 420 (MOO 420)

Module content:

Module credits: 16.00
Prerequisites: No prerequisites.
Contact time: 1 practical per week, 3 lectures per week
Language of tuition: English
Academic organisation: Mechanical and Aeronautical En
Period of presentation: Semester 2

Fossil fuel power stations 420 (MUU 420)

Module content:
This module contains a comprehensive study of all mechanical systems and processes of a fossil fuel power station. Analysis of steam cycles, combined cycle power generation, fuels and combustion, the draught group, steam generators and turbines, condenser, feedwater and circulating water systems, coal and ash handling, compressor plant, water treatment, the importance of HVAC, control and instrumentation, control philosophies and environmental considerations.

Module credits: 16.00
Prerequisites: No prerequisites.
Contact time: 1 practical per week, 3 lectures per week
Language of tuition: English
Academic organisation: Mechanical and Aeronautical En
Period of presentation: Semester 2

Numerical methods 420 (MWN 420)

Module content:

Module credits: 16.00
Prerequisites: No prerequisites.
<table>
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<tr>
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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 each student to familiarise himself or herself 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.