

University of Pretoria Yearbook 2016

BEng Mining Engineering Engage (12136071)

Duration of study 5 years

Total credits 596

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. 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 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	Double Medium
Academic organisation	EBIT Dean's Office
Period of presentation	Year

Core modules

General chemistry 172 (CHM 172)

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

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 116 (FSK 116)

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

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 6 lectures per week, Foundation Course

Language of tuition 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, 6 lectures per week

Language of tuition 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 (PWP 121)

Module credits	8.00
Prerequisites	No prerequisites.
Contact time	1 other contact session per week
Language of tuition	Both Afr and Eng
Academic organisation	Mining Engineering
Period of presentation	Semester 2

Module content

*Attendance modules only

The modules are presented during the first year of study and, subject to departmental arrangements, can be attended either during July or December holiday periods. The duration will be a minimum of two weeks, during which time the student will receive training in a mine as well as a mine workshop. Training will include the following maintenance aspects: rotary and percussion drills, transport equipment, hoists and hoist ropes, electrical motors, conveyor belts and pumps. A satisfactory report must be submitted within two weeks after the commencement of lectures of the following semester.

Calculus 158 (WTW 158)

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

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 Mathematics 1 116 (JPO 116)

Module credits	8.00
Prerequisites	No prerequisites.
Contact time	Foundation Course, 3 tutorials per week, 1 lecture per week
Language of tuition	English
Academic organisation	EBIT Dean's Office



Period of presentation	Semester 1
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Module content

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

Additional Mathematics 2 126 (JPO 126)

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

Background knowledge, problem-solving skills, conceptual understanding and mathematical reasoning skills required by WTW 161 and WTW 168.

Additional Physics 152 (JPO 152)

Module credits	8.00
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Prerequisites	No prerequisites.
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Contact time	Foundation Course, 1 lecture per week, 3 tutorials per week
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Language of tuition	English
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Academic organisation	School of Engineering
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Period of presentation	Semester 1
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Module content

Background knowledge, problem-solving skills, conceptual understanding and reasoning skills required by FSK116/176.

Additional Chemistry 1 161 (JPO 161)

Module credits	8.00
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Prerequisites	No prerequisites.
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Contact time	Foundation Course, 1 lecture per week, 3 tutorials per week
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Language of tuition	English
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Academic organisation	School of Engineering
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Period of presentation	Semester 2
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Module content

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

Humanities and social sciences 110 (HAS 110)

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

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)

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

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)

Module credits	16.00
Prerequisites	WTW 114 GS or WTW 158 GS
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 2

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)

Module credits	16.00
Prerequisites	No prerequisites.
Contact time	1 tutorial per week, 1 practical per week, 3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Electrical, Electronic and Com
Period of presentation	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)

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

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)

Module credits	16.00
Service modules	Faculty of Education
Prerequisites	No prerequisites.

Contact time 3 tutorials per week, 3 lectures per week

Language of tuition Both Afr and Eng

Academic organisation Mechanical and Aeronautical En

Period of presentation 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)

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 Metallur

Period of presentation 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)

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

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)

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 tutorial per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
Period of presentation	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)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	WTW 164
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
Period of presentation	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)

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



Language of tuition	English
Academic organisation	EBIT Dean's Office
Period of presentation	Semester 1

Module content

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

Additional Graphical communication 113 (JPO 113)

Module credits	8.00
Prerequisites	No prerequisites.
Contact time	1 lecture per week, Foundation Course, 3 tutorials per week
Language of tuition	English
Academic organisation	School of Engineering
Period of presentation	Semester 1

Module content

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

Additional Materials science 123 (JPO 123)

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

Module content

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

Additional Mechanics 125 (JPO 125)

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



Module content

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

Curriculum: Year 3

Minimum credits: 122

Core modules

Engineering statistics 220 (BES 220)

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

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.

Dynamics 210 (MSD 210)

Module credits	16.00
Prerequisites	FSK 116 or FSK 176 and SWK 122 and WTW 256 #
Contact time	2 tutorials per week, 3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mechanical and Aeronautical En
Period of presentation	Semester 1

Module content

Kinetics of systems of particles, Newton's 2nd law generalised for a system of particles, rate of change of momentum and angular momentum relations, work-energy relations, conservation laws, steady mass flow. Plane kinematics of rigid bodies, rotation, translation, general 2D motion, relative motion analysis. Moments and products of inertia. Plane kinetics of rigid bodies, equations of motion, rotation, translation, general 2D motion, work-energy relations. Vibration and time response.

Thermodynamics 221 (MTX 221)

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

Module content

Application overview. Concepts: system, control volume, property, state, process, cycles, mass, volume, density, pressure, pure substances, property tables, ideal gases. Work and heat. Internal energy, enthalpy, specific heat capacity. First Law of Thermodynamics for system and control volume. Conservation of mass. Processes: Adiabatic, isentropic, compressible and incompressible gases. Second Law of Thermodynamics for system and control volume. Entropy and enthalpy. Third Law of Thermodynamics. Introduction to vapour power, cooling and gas cycles. Experimental techniques in thermodynamics.

Virtual reality introduction to mining 210 (PMY 210)

Module credits 8.00

Contact time 2 lectures per week, 2 tutorials per week

Language of tuition English

Academic organisation Mining Engineering

Period of presentation Semester 2

Module content

Introduction: Mining in South Africa: Overview of mining and history in South Africa, Minerals and mining. Surface mining: Surface mining methods, Surface mining planning, Rock breaking, Rock loading and transport. Underground hard rock mining: A mine in outline, explanation of underground mining terms, basic mine layouts, shafts, development, stoping methods, compressed air, water and electrical reticulation. Underground coal mining: planning and development, rock breaking: stoping and tunnelling. Mine environmental engineering: ventilation practice, airflow, fans, gases, heat, psychrometry. Mine strata control: strata control in deep and shallow underground mines, strata control in coal mines.

Surveying 220 (SUR 220)

Module credits 16.00

Service modules Faculty of Engineering, Built Environment and Information Technology

Prerequisites WTW 114 GS/WTW 134

Contact time 1 practical per week, 2 lectures per week

Language of tuition Double Medium

Academic organisation Geography, Geoinf + Meteor

Period of presentation Semester 2

Module content

Adjustment and use of following instruments: Plane table, level, compass and theodolite. Elementary site surveying and leveling, tachometry. Definition of survey. Co-ordinate systems and bearing. Connections and polars. Methods of determining points. Elevation. Tachometry.

Strength of materials 210 (SWK 210)

Module credits 16.00

Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	SWK 122, WTW 164/WTW 124
Contact time	4 lectures per week, 2 tutorials per week
Language of tuition	Both Afr and Eng
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 ν . 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	Both Afr and Eng
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	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

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.

Programming and information technology 213 (MPR 213)

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

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.

Professional and technical communication 210 (PJJ 210)

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 Mining Engineering

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.

Curriculum: Year 4

Minimum credits: 144

Core modules

Introductory geology 151 (GLY 151)

Module credits 16.00

Service modules Faculty of Engineering, Built Environment and Information Technology

Prerequisites Refer to Regulation 1.2

Contact time 1 practical per week, 4 lectures per week

Language of tuition English

Academic organisation 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; classification of rocks; internal and external geological processes; landscape formation; influences of geological environment on mankind; geological time and Earth's history through time. Geological maps; geological profiles; identification and description minerals and rocks.

Historical geology 161 (GLY 161)

Module credits 8.00

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

Language of tuition English

Academic organisation Geology

Period of presentation Quarter 4

Module content

Principles of stratigraphy and stratigraphic nomenclature; geological dating and international and South African time scales; Africa framework and tectonic elements of South Africa; introduction to depositional environments. Overview of the historical geology of South Africa, from the Archaean to the present: major stratigraphic units, intrusions and tectonic/metamorphic events - their rock types, fossil contents, genesis and economic commodities. Principles of palaeontology and short description of major fossil groups: fossil forms, ecology and geological meaning. Geological maps and profiles; rock samples.

Mineral economics 320 (PME 320)

Module credits 16.00

Prerequisites No prerequisites.

Contact time 1 tutorial per week, 4 lectures per week

Language of tuition English

Academic organisation Mining Engineering

Period of presentation Semester 2

Module content

The objective is for the student to understand fundamental economic theory pertaining to the mineral and mining industry and its overall effects on the broader South African economy. The student will be able to interpret and understand company annual results. The student should be able to understand and apply the SAMREC/SAMVAL code during the evaluation and classification of resources and reserves. The student should understand the effect of supply and demand pertaining to the mineral and mining industry (micro and macro economic factors). To understand the unique aspects related to marketing of minerals with reference to the cyclic nature of the industry. Apply economic and engineering reasoning to specific problems in the minerals and mining industry so as to analyse and interpret the opportunities and threats facing this industry. To understand and apply the fundamentals of technical mine valuation, including mineral rights, prospecting methods, sampling, mass and mineral content of ore as well as management and control factors. The latter include controlling and managing of widths, stoping width versus tramming and milling width, ore dilution, mine call factor and cut-off grade.

Industrial excursions 300 (PNB 300)

Module credits 8.00

Prerequisites No prerequisites.

Contact time 3 practicals per week

Language of tuition English

Academic organisation Mining Engineering

Period of presentation Semester 1

Module content

The mining industry requires that students are exposed to the mining industry by visiting a collection of mines with the purpose of familiarising them with current trends in mining practice and mining methods. This module hopes to provide a “snapshot” of the mining industry as it is at the time of the tour. This tour requires attendance and participation in five one-day visits to mines. The excursions are organised during the first semester of the third year, and take place during the July recess at the end of the semester. Students must, before the second semester commences, submit a group report on the visits during the second semester.

Introduction to project 321 (PSC 321)

Module credits 8.00

Prerequisites PNB 300

Contact time 1 tutorial per week, 2 lectures per week

Language of tuition English

Academic organisation Mining Engineering

Period of presentation Semester 2

Module content

Reporting technical information: typical report structure, literature survey, data presentation (tables, graphs, diagrams), referencing, presenting results, conclusions, and recommendations. Identification of a suitable subject for the Final Year Project. Planning of project execution.

Thermofluids 310 (MTV 310)

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

Module content

Introduction: Liquids and gases, pressure, viscosity, temperature, heat. Introduction to Navier-Stokes and continuity equations. Definitions and properties of fluids, fluid statics, fluid dynamics, Bernoulli equations. Flow measurements. Dimensional analysis: force, drag, Reynolds number, force coefficient, power. Flow in pipes and channels: friction coefficients and Reynolds number, pressure drop; laminar, turbulent and transitional flow. Flow over bodies: drag and lift. Experimental techniques in fluid mechanics. Introduction to basic thermodynamic heat transfer concepts: conduction (steady state and transient heat conduction), extended surfaces, applications.

Surface mining and geotechnics 311 (PMY 311)

Module credits 16.00

Prerequisites PMY 210

Contact time 3 lectures per week, 2 tutorials per week

Language of tuition English

Academic organisation Mining Engineering

Period of presentation Semester 1

Module content

Surface mining methods: Introduction, classification of ore reserves and terminology. Earth moving: Loading shovels and methods, haulage trucks, productivity and tires, introduction to bucket wheel excavators, conveyor systems and in-pit crushers, in-pit crushing-conveying system, application of draglines and terminology. Introduction to mine planning, mine development phases, block modelling, methods of sequencing, stripping ratios and breakeven ratios. Introduction to mining environment, rehabilitation and closure, integrated environmental management, environmental impact studies, water management and rehabilitation planning and costing. Geotechnics include understanding discontinuities in rock mass, stereo nets, cohesion and friction. Rock behaviour pertaining to excavations, understanding plane, circular and wedge failures, Rock slope safety factors. Slope stabilisation, neutral line theory, effects of water in a slope, monitoring of slopes and instruments available for slope stability monitoring, Risk concepts pertaining to slopes and a case study is discussed. Aspects of the Mine Health and Safety Act are also dealt with.



Experiential training 320 (PPY 320)

Module credits	16.00
Prerequisites	No prerequisites.
Language of tuition	English
Academic organisation	Mining Engineering
Period of presentation	Semester 2

Module content

The mining industry requires students to become exposed to mining by working on mines during the December recess period at the end of the second academic year. The student is required to work for a minimum period of six weeks on a mine, and then compile a report on the work completed for submission at a prescribed date in the first semester of the third academic year.

Mining 320 (PMY 320)

Module credits	16.00
Prerequisites	PMY 311, PPY 220
Contact time	2 tutorials per week, 3 lectures per week
Language of tuition	English
Academic organisation	Mining Engineering
Period of presentation	Semester 2

Module content

Mining 320 provides an overview of mining by covering the following subject-matter: history of mining in South Africa, underground mining systems, and a brief overview of mine environmental control and mine strata control. Then the module covers general mine layouts, mine plan reading, mine surveying, electricity supply, transport systems, water management systems, and mine fires. This feat is achieved through the study of various mining methods and case studies.

Explosives engineering 321 (PRX 321)

Module credits	8.00
Prerequisites	MTX 221
Contact time	2 tutorials per week, 3 lectures per week
Language of tuition	English
Academic organisation	Mining Engineering
Period of presentation	Semester 2

Module content

Explosive engineering: The importance of improved safety standards, cost effectiveness and productivity has driven technical mining personnel to examine all facets of their operations. Increasingly, it has been realized that an efficient drilling and blasting program will impact positively throughout the mining operation, from loading to maintenance, hauling to crushing, ground support to scaling and grade control to recover with an invariable increase in the overall profitability through technical advanced projects. Through the safe, efficient and innovative use of explosives for rock breaking the mining engineer will make a positive contribution to the overall mining operation. Due to the nature of the topics discussed in this module, a number of case studies are used to emphasise the safe handling, application and destruction of explosives. The Mine Health and Safety Act is dealt with and the Explosives Act receives specific attention.

Minerals processing 310 (NMP 310)

Module credits	16.00
Prerequisites	No prerequisites.
Contact time	3 lectures per week, 4 practicals per week
Language of tuition	English
Academic organisation	Materials Science and Metallur
Period of presentation	Semester 1

Module content

Minerals processing in perspective (economic importance, economic nature of mineral deposits, mineral properties and analysis, mineral processing functions). Liberation analysis (importance and measurement of liberation; particle size analysis). Comminution (theories and principles, crushers, grinding mills). Screening and classification (industrial screening, cyclones). Concentration processes (gravity concentration, dense medium concentration). Froth flotation.

Engineering management 310 (BSS 310)

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

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 (discrete 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).

Engineering activity and group work 320 (MIA 320)

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

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.

Curriculum: Final year

Minimum credits: 144

Core modules

Structural geology 254 (GLY 254)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	GLY 151, GLY 161, WTW 114/WTW 158 and FSK 116/FSK 176
Language of tuition	English
Academic organisation	Geology
Period of presentation	Quarter 2

Module content

Integrated theoretical and practical course dealing with the principles of rock deformation and analysis of deformed rocks. Stress, strain and rheology, joints, experimental rock deformation, fault systems and Anderson's theory of faulting. Folds and interference folding, tectonic fabrics, shear zones, progressive deformation. Stereographic projection and structural analysis.

Geodynamics and ore formation 352 (GLY 352)

Module credits	18.00
Prerequisites	GLY 254
Contact time	4 lectures per week, 2 practicals per week
Language of tuition	English
Academic organisation	Geology
Period of presentation	Quarter 2

Module content

Principles of ore-forming processes and geological environments of ore formation; ore classification schemes; geometry of ore bodies; systematic review of major metallic and non-metallic ore types with examples; ore samples and ore mineralogy; mapping techniques.

Mine ventilation engineering 410 (PEE 410)

Module credits	16.00
Prerequisites	MTV 310, Finalists only
Contact time	1 tutorial per week, 2 practicals per week, 3 lectures per week
Language of tuition	English
Academic organisation	Mining Engineering
Period of presentation	Semester 1

Module content

Mine ventilation methods; primary and secondary ventilation methods, ventilation strategies for coal and hard rock mining environments including base metal mines. Mine development ventilation methods, mine air control, different types of fans including fan performances and air dilution calculations. Refrigeration: Elementary refrigeration principles, including concepts and methods, chilled water systems, including cooling distribution methods. Elementary mine ventilation planning, basic planning parameters and elementary mine ventilation economics and the impact of incorrect design and applications on safety and health. Mine gases, their origin and gas/coal dust explosions. Aspects of the Mine Health and Safety act are also dealt with.

Mining 410 (PMY 410)

Module credits	16.00
Prerequisites	PRX 321, PME 320, PMY 320, Finalists only
Contact time	3 lectures per week, 1 tutorial per week, 2 practicals per week
Language of tuition	English
Academic organisation	Mining Engineering
Period of presentation	Semester 1

Module content

Specific mining techniques. Shafts: Types, methods and equipment for sinking; economic considerations. Tunneling: Design, development techniques and equipment. Design and construction of large excavation. Design, construction, reinforcing and repair of ore passes. Fires in gold and coal mines: Causes, prevention, detection, combating and insurance. Flooding: Water sources, results, dangers, sealing and control.

Strata control 410 (PSZ 410)

Module credits	16.00
Prerequisites	SWK 210, PMY 320, Finalists only
Contact time	3 lectures per week, 2 practicals per week, 1 tutorial per week
Language of tuition	English
Academic organisation	Mining Engineering
Period of presentation	Semester 1

Module content

Three dimensional stress and strain tensors and linear elasticity. The state of stress in the earth's crust. Rock material and rock mass failure criteria. The response of the rock mass to underground excavations, energy release rate and excess shear stress. Mining induced seismicity, rock bursts and measures to minimise mining induced seismicity so as to improve SHE. Elementary mine layout design, pillar design and underground excavation support and their effects on SHE. Stress analysis of mining layouts and mine layout optimisation.

Mine design 422 (PMZ 422)

Module credits	42.00
Prerequisites	PMY 410, PSZ 410, PEE 410. PNB 400, Finalists only

Contact time 4 lectures per week

Language of tuition English

Academic organisation Mining Engineering

Period of presentation Semester 2

Module content

This module entails the completion of an engineering project from concept to delivery. The student must demonstrate mastery of a mining engineering project. The module focuses on the formulation of a mining engineering problem, the development of appropriate extraction methodologies, project planning and management and then completion of a technical project of a given nature, scope and complexity.

Students are required to design a mine at the conceptual business case level. Students are given a surface plan and borehole data from which they have to design a mine in teams of 3 – 5 students. They have access to a mining engineer in industry to assist with advice. The design has to incorporate a market analysis, layout design, working method, surface layout, environmental impacts and financial analysis. The design is submitted in book form and each team member has to do a presentation of the design.

Project 411 (PSC 411)

Module credits 10.00

Prerequisites PSC 321, Finalists only

Contact time 1 tutorial per week

Language of tuition English

Academic organisation Mining Engineering

Period of presentation Semester 2

Module content

The project involves the execution of an analytical and/or experimental research project under guidance of a lecturer. During the second semester of the third year of study students must select a suitable research topic, to be approved by the head of department. Data for the approved project will be collected during the practical training period during the summer recess at the end of the third year of study. A comprehensive and detailed project report must be compiled and submitted for evaluation at a prescribed date in the first semester of the fourth year. The student must also prepare a presentation of the project for an oral examination at the end of the semester.

Mine operational risk management 423 (PMY 423)

Module credits 8.00

Prerequisites Finalists only

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

Language of tuition Both Afr and Eng

Academic organisation Mining Engineering

Period of presentation Semester 1

Module content

Selected topics in operational risk management; Introduction and context; Risk management concepts, words, and models; Risk assessment principles; Human factors; Leading practice; Layered risk management (including identification, assessment and control); Scoping risk assessment; Integrating outcomes into the business; ORM journey tool; Line management and OR; Safety and mineral Statistical Structures and Codes; Legal aspects.

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 English

Academic organisation Engineering and Tech Man

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.

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.