



University of Pretoria Yearbook 2016

BEng Industrial Engineering Engage (12136011)

Duration of study 5 years

Total credits 588

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 171 (CHM 171)

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

Module content

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

Physics 176 (FSK 176)

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



Module content

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

Professional orientation 110 (JPO 110)

Module credits 8.00

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

Contact time 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.



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.

Workshop practice 121 (WWP 121)

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

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.

Additional Chemistry 1 111 (JPO 111)

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



Module content

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

Additional Physics 122 (JPO 122)

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 physical reasoning skills required by FSK 116/176.

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

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

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 mathematical reasoning skills required by WTW 161 and WTW 168.



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.

Productivity 220 (BPZ 220)

Module credits 16.00

Prerequisites No prerequisites.

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

Language of tuition Both Afr and Eng

Academic organisation Industrial and Systems Eng

Period of presentation Semester 2

Module content

Qualifying and quantifying productivity: efficiency, effectiveness, utilisation, profitability and competitiveness. Method study: critical examination and process flow charts and diagrams. Work measurement: time study and activity sampling. Organisational behaviour: motivation, incentive schemes, group forming, work teams, job design and change management. Ergonomics.

Manufacturing and design 217 (MOW 217)

Module credits 16.00

Prerequisites MGC 110

Contact time 3 lectures per week, 4 tutorials per week

Language of tuition Both Afr and Eng

Academic organisation Mechanical and Aeronautical En



Period of presentation Semester 1

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.

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.

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.

Professional and technical communication 210 (BJJ 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	Industrial and Systems Eng
Period of presentation	Semester 1



Module content

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

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.



Curriculum: Year 4

Minimum credits: 154

Core modules

Business law 310 (BER 310)

Module credits 16.00

Service modules Faculty of Engineering, Built Environment and Information Technology

Prerequisites No prerequisites.

Contact time 4 lectures per week

Language of tuition Both Afr and Eng

Academic organisation Mercantile Law

Period of presentation Semester 1

Module content

Introduction to law. General principles of the law of contract. Specific contracts: purchase contracts; letting and hiring of work; employment contracts. Agency. General aspects of entrepreneurial law. Dispute resolution – mediation and arbitration.

Information systems design 320 (BID 320)

Module credits 16.00

Prerequisites No prerequisites.

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

Language of tuition English

Academic organisation Industrial and Systems Eng

Period of presentation Semester 2

Module content

Systems development planning, system requirement analysis, different approaches towards structured analysis and design of systems, process design, database design and normalization, object-oriented design and modelling, information system application building and testing.

Industrial logistics 320 (BLK 320)

Module credits 16.00

Prerequisites (BOB 310)

Contact time 4 lectures per week, 2 tutorials per week

Language of tuition Both Afr and Eng

Academic organisation Industrial and Systems Eng

Period of presentation Semester 2



Module content

Role of logistics in the economy and organisation. Customer service. Forecasting. Logistics information systems and electronic information flow. Inventory management. Managing materials flow. Distribution channels. Transportation. Warehousing. Packaging. Strategic purchasing. Global logistics. Organising and controlling logistics. Supply chain management. Supply chain finance and performance measurement. SCOR reference models. Implementing logistics strategy.

Operational management 310 (BOB 310)

Module credits	16.00
Prerequisites	No prerequisites.
Contact time	2 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	Industrial and Systems Eng
Period of presentation	Semester 1

Module content

Introduction to operations management, operations strategy and competitiveness. World-class and agile manufacturing. Operations planning in the service industries. The manufacturing management environment. Batching principles (EOQ and DEL). Manufacturing planning and control systems. Sales and operations planning. Capacity planning and control. Demand management. Master production scheduling. Materials requirements planning (MRP). Distribution requirements planning. Just-in-time (JIT) manufacturing. Synchronous manufacturing (Theory of constraints). Comparing MRP, JIT and TOC. Shop-floor scheduling and control. Integration and implementation of manufacturing planning and control systems. Enterprise Resource Planning (ERP) systems. Business process transformation.

Practical training 310 (BPY 310)

Module credits	16.00
Prerequisites	No prerequisites.
Contact time	1 other contact session per week
Language of tuition	Both Afr and Eng
Academic organisation	Industrial and Systems Eng
Period of presentation	Semester 1 or Semester 2

Module content

*Attendance module only

During or at the end of the second year of study, students in industrial engineering undergo at least six weeks of prescribed practical training in the industry. A satisfactory report on the practical training must be submitted to the Faculty Administration within one week of registration. In exceptional circumstances the prescribed minimum period can be reduced, as approved by the chairman of the School of Engineering.

Simulation modelling 321 (BUY 321)

Module credits	16.00
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Prerequisites	(BAN 313)
Contact time	4 lectures per week, 2 tutorials per week
Language of tuition	English
Academic organisation	Industrial and Systems Eng
Period of presentation	Semester 2

Module content

Introduction to simulation as technique. Simulation methodology. Formulation of problem situations by means of simulation models with the emphasis on discrete models. Input and output analysis. Introduction to simulation software.

Financial management 110 (FBS 110)

Module credits	10.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Natural and Agricultural Sciences
Prerequisites	No prerequisites.
Contact time	3 lectures per week
Language of tuition	English
Academic organisation	Financial Management
Period of presentation	Semester 1

Module content

*Only for BSc (Mathematical Statistics. Construction Management, Real Estate and Quantity Surveying) and BEng (Industrial Engineering) students.

Purpose and functioning of financial management. Basic financial management concepts. Accounting concepts and the use of the basic accounting equation to describe the financial position of a business. Recording of financial transactions. Relationship between cash and accounting profit. Internal control and the management of cash. Debtors and short-term investments. Stock valuation models. Depreciation. Financial statements of a business. Distinguishing characteristics of the different forms of businesses. Overview of financial markets and the role of financial institutions. Risk and return characteristics of various financial instruments. Issuing ordinary shares and debt instruments.

Industrial analysis 313 (BAN 313)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	No prerequisites.
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	English
Academic organisation	Industrial and Systems Eng
Period of presentation	Semester 1



Module content

Mathematical statistics provides the basis for a number of important applications in the engineering environment. This module provides an introduction to the most important of these applications and will include the following syllabus themes: Monte Carlo simulation, decision analysis, forecasting and data-dependent modelling.

Manufacturing systems 311 (MVS 311)

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

Module content

Basic knowledge of conventional manufacturing processes like casting, forming, machining and joining. Modern manufacturing of plastic products, powder metallurgy, micro-electronic manufacturing and non-traditional machining. Quality control by work-holding devices, measurement, inspection and testing and determination of process capability. Manufacturing automation, rapid prototyping and free form fabrication. Manufacturing systems design concepts like Jobshop, Flowshop, Leanshop with linked cells, Projectshop and continuous processing.

Facilities planning 320 (BFB 320)

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

Module content

This module introduces the principles, approaches, methods, techniques and tools to systematically determine facility requirements, determine the required space of and relationships between activities, develop and evaluate alternative plans and layouts and present the results. Aspects such as facilities location, manufacturing and service process design, capacity planning, materials handling, personnel facilities, storage and warehousing are also addressed. A structured facility design project forms an integral part of the course.

Operational research 312 (BOZ 312)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	No prerequisites.



Contact time 3 lectures per week, 1 tutorial per week

Language of tuition English

Academic organisation Industrial and Systems Eng

Period of presentation Semester 1

Module content

Introduction to Operations Research, and more specifically the branch of optimisation and its application to industrial problems. In the module the topics of linear and integer linear programming are introduced. The focus is on identifying and scoping appropriate problems, the subsequent formulation of problems, solution algorithms, and post-optimisation sensitivity analysis. Students are exposed to solving problems using optimisation software.

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 (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).

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

Labour relations 320 (ABV 320)

Module credits 20.00

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

Prerequisites No prerequisites.

Contact time 3 lectures per week

Language of tuition Both Afr and Eng

Academic organisation Human Resource Management

Period of presentation Semester 2

Module content

The theoretical basis of Labour Relations

In this section the basic concepts, historical context and theoretical approaches to the field of labour relations will be discussed. The institutional framework in which labour relations operates, will be addressed with particular emphasis on the structural mechanisms and institutional processes. The service relationship that forms the basis of labour relations practices, will also be analysed.

Labour Relations practice

In this section students are taught the conceptual and practical skills related to practice aspects such as handling of grievances, disciplining, retrenchments, collective bargaining, industrial action and dispute resolution.

Quality assurance 410 (BGC 410)

Module credits 16.00

Prerequisites No prerequisites.

Contact time 3 lectures per week, 1 tutorial per week

Language of tuition Both Afr and Eng

Academic organisation Industrial and Systems Eng

Period of presentation Semester 1

Module content

Introduction to quality and quality management systems. Statistical process control. Acceptance control.

Operational research 410 (BON 410)

Module credits 16.00

Prerequisites (BES 220), (BOZ 312)



Contact time 1 tutorial per week, 3 lectures per week

Language of tuition English

Academic organisation Industrial and Systems Eng

Period of presentation Semester 1

Module content

Review of basic probability, Markov chain models, Markov decision models. Queuing systems: M/M/1 queues (both finite and infinite capacity), etc.; deterministic and stochastic inventory models. Competitive games: pure and mixed strategies, optimum strategy, two-person zero-sum games, graphical methods and applications, LP methods for games.

Project 410 (BPJ 410)

Module credits 16.00

Prerequisites Finalists only

Contact time 1 other contact session per week

Language of tuition English

Academic organisation Industrial and Systems Eng

Period of presentation Semester 1

Module content

Choice of project topic. Appointment of project leader. Literature study, analysis and creation of alternatives.

Project 420 (BPJ 420)

Module credits 24.00

Prerequisites BPJ 410

Contact time 2 other contact sessions per week

Language of tuition English

Academic organisation Industrial and Systems Eng

Period of presentation Semester 2

Module content

Narrowing of topic choice. Detailed solution of chosen alternative. Writing of final project report and presentation of project.

Practical training 410 (BPY 410)

Module credits 16.00

Prerequisites No prerequisites.

Contact time 1 other contact session per week

Language of tuition Both Afr and Eng

Academic organisation Industrial and Systems Eng



Period of presentation Semester 1

Module content

*Attendance module only During or at the end of the third year of study, students in industrial engineering undergo at least six weeks of prescribed practical training in the industry. A satisfactory report on the practical training must be submitted to the department within one week of registration. In exceptional circumstances the prescribed minimum period can be reduced, as approved by the chairman of the School of Engineering.

Business engineering 421 (BPZ 421)

Module credits 16.00

Contact time 4 lectures per week, 2 tutorials per week

Language of tuition English

Academic organisation Industrial and Systems Eng

Period of presentation Semester 2

Module content

Integration of engineering functions; strategic planning; organisational structures; business management; systems engineering; work-flow management; process modelling; business architecture; change management and motivation; marketing management and industry exposure. Business management game project.

Management accounting 410 (BSR 410)

Module credits 16.00

Service modules Faculty of Engineering, Built Environment and Information Technology

Prerequisites FBS 110

Contact time 6 lectures per week

Language of tuition English

Academic organisation Financial Management

Period of presentation Semester 1

Module content

The work of management and the need for managerial accounting information. The changing business environment. Cost terms, concepts, and classification. Job order costing. Process costing. Activity-based costing and quality management. Cost-volume-profit relations. Variable and fixed costing. Budgeting and control. Standard costs and flexible budgets. Segment reporting and decentralisation. Relevant costs for decision-making. Allocations of service departments cost to operating departments.

Systems engineering 410 (BSS 410)

Module credits 16.00

Prerequisites No prerequisites.

Contact time 3 lectures per week, 1 tutorial per week

Language of tuition English



Academic organisation Industrial and Systems Eng

Period of presentation Semester 2

Module content

A company's ability to remain competitive hinges increasingly on its ability to develop successful products. In practice this is often determined by how well the company performs systems engineering. Applying the principles of systems engineering allows designers to understand the big picture, i.e. how a product needs to perform technically as well as within its application domain, e.g. environmentally, human interfaces, and so on. This module equips the student with the relevant tools and process understanding to successfully apply systems engineering to product development. Some of these tools and processes include specification practices, requirements engineering, systems engineering management and verification and validation processes.

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.

Engineering economics 420 (BIE 420)

Module credits 8.00

Prerequisites No prerequisites.

Contact time 3 lectures per week

Language of tuition Both Afr and Eng

Academic organisation Industrial and Systems Eng

Period of presentation Semester 2



Module content

Money-time relationships and equivalence (interest formulae, effective interest rate, bonds and loans). Bases for comparison of alternatives (present worth, annual worth, Internal rate of return, external rate of return, investment balance diagrams, Decision making among alternatives (useful lives equal to study period, useful lives different among alternatives, mutually exclusive alternatives in terms of combinations of proposals). The influence of inflation on engineering economic calculations. Decision making among alternatives on an after-tax basis. Replacement analysis (the economic life of an asset, retirement without replacement). Risk analysis of cash flows.

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.