

University of Pretoria Yearbook 2025

BEng in Industrial Engineering 4-year programme (12130020)

Department Industrial and Systems Engineering

Minimum duration of study 4 years

Total credits 595

NQF level 08

Programme information

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

Learning outcomes of the BEng degree:

A graduate in engineering should be able to apply the following skills on an advanced level:

- Engineering problem solving.
- Application of specialist and fundamental knowledge, with specific reference to mathematics, basic sciences and engineering sciences.
- Engineering design and synthesis.
- Investigation, experimentation and data analysis.
- Engineering methods, skills, tools and information technology.
- Professional and general communication.
- Awareness and knowledge of the impact of engineering activity on society and the physical environment.
- Work in teams and in multidisciplinary environments.
- An awareness and ability for lifelong learning.
- An awareness and knowledge of principles of professional ethics and practice.
- Awareness and knowledge of engineering management principles and economic decision-making.

Learning contents of the BEng programmes:

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

Knowledge areas:

- Mathematics, including numerical methods and statistics (13%)

- b. Basic sciences: the natural sciences essential to the programme (15%)
- c. Engineering sciences (40%)
- d. Engineering design and synthesis (16%)
- e. Computing and information technology (5%)
- f. Complementary studies: communication, economy, management, innovation, environmental impact, ethics, engineering practice (11%).

Admission requirements

Important information for all prospective students for 2025

The admission requirements below apply to all who apply for admission to the University of Pretoria with a **National Senior Certificate (NSC) and Independent Examination Board (IEB) qualifications**. [Click here](#) for this Faculty Brochure.

Minimum requirements: 4-year programme			
Achievement level			
English Home Language or English First Additional Language	Mathematics	Physical Sciences	APS
NSC/IEB	NSC/IEB	NSC/IEB	
5	6	6	35

The suggested second-choice programmes for the Bachelor in Engineering in Industrial Engineering are Bachelor of Science in Chemistry, Bachelor of Science in Mathematics and Bachelor of Science in Physics.

Minimum requirements: 5-year programme [previously called ENGAGE]			
Achievement level			
English Home Language or English First Additional Language	Mathematics	Physical Sciences	APS
NSC/IEB	NSC/IEB	NSC/IEB	
5	65%	65%	33

Students may apply directly to be considered for the 5-year Bachelor of Engineering programme..

Life Orientation is excluded when calculating the APS.

Applicants currently in Grade 12 must apply with their final Grade 11 (or equivalent) results.

Applicants who have completed Grade 12 must apply with their final NSC or equivalent qualification results.

Please note that meeting the minimum academic requirements does not guarantee admission.

Successful candidates will be notified once admitted or conditionally admitted.

Unsuccessful candidates will be notified after 30 June.

Applicants should check their application status regularly on the UP Student Portal at [click here](#).

Applicants with qualifications other than the abovementioned should refer to the International

undergraduate prospectus 2025: Applicants with a school leaving certificate not issued by Umalusi (South Africa), available at [click here](#).

International students: [Click here](#).

Transferring students

A transferring student is a student who, at the time of applying at the University of Pretoria (UP) is/was a registered student at another tertiary institution. A transferring student will be considered for admission based on NSC or equivalent qualification and previous academic performance. Students who have been dismissed from other institutions due to poor academic performance will not be considered for admission to UP.

Closing dates: Same as above.

Returning students

A returning student is a student who, at the time of application for a degree programme is/was a registered student at UP, and wants to transfer to another degree at UP. A returning student will be considered for admission based on NSC or equivalent qualification and previous academic performance.

Note:

- Students who have been excluded/dismissed from a faculty due to poor academic performance may be considered for admission to another programme at UP, as per faculty-specific requirements.
- Only ONE transfer between UP faculties and TWO transfers within a faculty will be allowed.
- Admission of returning students will always depend on the faculty concerned and the availability of space in the programmes for which they apply.

Closing date for applications from returning students

Unless capacity allows for an extension of the closing date, applications from returning students must be submitted before the end of August via your UP Student Centre.

Other programme-specific information

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

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

Please note:

1. All students are 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.
2. Students registered for Chemical Engineering who have passed CBI 311 or CBI 410, receive credit for CBI 310.
3. Mechanical Engineering: For the Aeronautical Option, the themes of both the Design and the Project must be aeronautical-related.
4. Offering of electives depends on the availability of resources and industry support.

Promotion to next study year

Promotion to the second semester of the first year and to the second year of study

- 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 enrol 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 laptop 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.

- 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 enrol 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.

- 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 relevant head of department, 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% (not rounded) 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: 145

Fundamental modules

Academic orientation 112 (UPO 112)

Module credits	0.00
NQF Level	00
Language of tuition	Module is presented in English
Department	EBIT Dean's Office
Period of presentation	Year

Core modules

General chemistry 172 (CHM 172)

Module credits	16.00
NQF Level	05
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	Admission to relevant programme.
Contact time	1 web-based period per week, 1 practical per week, 1 discussion class per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	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.

Electricity and electronics 111 (EBN 111)

Module credits	16.00
NQF Level	05
Prerequisites	Admission to relevant programme.
Contact time	3 lectures per week, 1 tutorial per week, 9 hours practical per semester
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering

Period of presentation Semester 1

Module content

The general objective of this module is to develop expertise in solving electric and electronic circuits. The topics covered in the course are Ohm's law, Kirchoff's current and voltage laws, voltage and current division, mesh current and node voltage methods, linearity, Thevenin and Norton equivalent circuits, source transformation, power transfer, energy storage elements in circuits (inductors and capacitors), and operational amplifiers and applications. Although circuits will mostly be solved using direct current (DC) sources, the final part of the course will consider methods to solve circuits using alternating current sources (AC).

Physics 116 (FSK 116)

Module credits 16.00

NQF Level 05

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 Module is presented in English

Department 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.

Introduction to sustainable engineering I 110 (JSU 110)

Module credits 8.00

NQF Level 05

Prerequisites No prerequisites.

Contact time 2 practicals per week

Language of tuition Module is presented in English

Department EBIT Dean's Office

Period of presentation Semester 1

Module content

Introduction to fundamentals of engineering, professional development of engineers and sustainability practices. This module is intended to introduce students engineering, sustainability, design, technical communication and academic writing, as well as other engineering professional practices and skill sets necessary for your future employability. Technical communication in most cases can be broken down into writing, technical argument, and explanation, data visualisation as well as presentations. Specific components will include (but are not limited to) the following: an introduction to your chosen engineering discipline, ethics and sustainability, industry standards and professional conduct, teamworking, leadership, project management, career preparation and employability.

Introduction to sustainable engineering II 120 (JSU 120)

Module credits	8.00
NQF Level	05
Prerequisites	No prerequisites.
Contact time	2 practicals per week
Language of tuition	Module is presented in English
Department	EBIT Dean's Office
Period of presentation	Semester 2

Module content

Introduction to fundamentals of engineering, professional development of engineers and sustainability practices. This module is intended to further expose students to engineering, sustainability (social, economic and environmental) implications on design as well as appropriate technical communication practices. Specific components will include (but are not limited to) the following: an introduction to your chosen engineering discipline, the design process, critical, creative and entrepreneurial thinking, decisionmaking, problem solving, ethics and sustainability, industry standards and professional conduct, teamworking, leadership, project management, career preparation and employability.

Graphical communication 110 (MGC 110)

Module credits	16.00
NQF Level	05
Prerequisites	Admission to relevant programme.
Contact time	3 lectures per week, 3 tutorials per week
Language of tuition	Module is presented in English
Department	Mechanical and Aeronautical Engineering
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

NQF Level 05

Prerequisites Admission to relevant programme.

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

Language of tuition Module is presented in English

Department Materials Science and Metallurgical Engineering

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.

Statics 122 (SWK 122)

Module credits 16.00

NQF Level 05

Service modules Faculty of Natural and Agricultural Sciences

Prerequisites WTW 158, admission to relevant programme

Contact time 4 lectures per week, 2 tutorials per week

Language of tuition Module is presented in English

Department Civil Engineering

Period of presentation 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 158 (WTW 158)

Module credits	16.00
NQF Level	05
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	60% for Mathematics in Grade 12
Contact time	4 lectures per week, 1 tutorial per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
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.

Mathematics 164 (WTW 164)

Module credits	16.00
NQF Level	05
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	WTW 114 or WTW 158
Contact time	1 tutorial per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
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.

Workshop practice 121 (WWP 121)

Module credits	1.00
NQF Level	05
Prerequisites	No prerequisites.
Contact time	1 other contact session per week
Language of tuition	Module is presented in English
Department	Mechanical and Aeronautical Engineering
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.

Curriculum: Year 2

Minimum credits: 144

Core modules

Engineering statistics 220 (BES 220)

Module credits	8.00
NQF Level	06
Prerequisites	WTW 158 GS, WTW 164 GS. Admission to relevant programme.
Contact time	3 lectures per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
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.

Professional and technical communication 210 (BJJ 210)

Module credits	8.00
NQF Level	06
Prerequisites	No prerequisites.
Contact time	1 discussion class per week, 3 lectures per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 1

Module content

This module focuses on various aspects of communication that takes place around engineering projects. Aspects of communication covered the formal and informal forms of written, verbal, visual and non-verbal communication. Topics covered include project proposal and project report writing, project presentations, data visualisation, change management, communication styles, conflict management, etc. The purpose of the module is to develop students' ability to successfully navigate the communication of a project in a professional manner.

Productivity 220 (BPZ 220)

Module credits	16.00
NQF Level	06
Prerequisites	No prerequisites.

Contact time 4 lectures per week, 2 discussion classes per week

Language of tuition Module is presented in English

Department Industrial and Systems Engineering

Period of presentation Semester 2

Module content

This module takes a holistic approach to measuring and improving productivity. Students will learn how to measure, calculate and analyse the productivity of processes (yield), labour, and machines. This part of the module will cover basic, intermediate and relatively advanced calculations of productivity, using case studies, to prepare students for the even more complex calculations of real-life operations. The module then also covers a wide variety of techniques and tools that can be used to make work easier, better, faster, and cheaper. The approach taught correlates with that of Lean Management and the Toyota Production System, but also includes Theory of Constraints, and work study approaches. This is a module full of ready-to-use techniques regularly used in contemporary business environments.

Community-based project 203 (JCP 203)

Module credits 8.00

NQF Level 06

Prerequisites No prerequisites.

Contact time 1 lecture per week

Language of tuition Module is presented in English

Department Informatics

Period of presentation Year

Module content

The Joint Community Project module is a credit-bearing educational experience where students are not only actively engaging in interpersonal skills development but also participate in service activities in collaboration with community partners. Students are given the opportunity to practice and develop their interpersonal skills formally taught in the module by engaging in teamwork with fellow students from different disciplines and also with non-technical members of the community. The module intends for the student to develop through reflection, understanding of their own experience in a team-based workspace as well as a broader understanding of the application of their discipline knowledge and its potential impact in their communities, in this way also enhancing their sense of civic responsibility. Compulsory class attendance 1 week before Semester 1 classes commence.

Manufacturing and design 217 (MOW 217)

Module credits 16.00

NQF Level 06

Prerequisites MGC 110, admission to relevant programme

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

Language of tuition Module is presented in English

Department Mechanical and Aeronautical Engineering

Period of presentation Semester 1

Module content

Conceptual consideration of the phases in mechanical design acknowledging the many feedbacks & iterations. Detailed exposure to machine elements, including fasteners, gears, belts, chains and bearings. Selection of standard mechanical components. Detailed exposure to machining processes used to manufacture components for mechanical machines. Detailed exposure to GD&T (Geometric Dimensioning & Tolerancing) needed for manufacturing drawings.

Programming and information technology 213 (MPR 213)

Module credits 16.00

NQF Level 06

Prerequisites No prerequisites.

Contact time 4 lectures per week, 2 practicals per week

Language of tuition Module is presented in English

Department Mechanical and Aeronautical Engineering

Period of presentation Semester 1

Module content

Spreadsheet applications: Formulas and calculations, named ranges, plotting and trend lines, goal seek, linear programming, importing and exporting data, data navigation and filtering. Programming fundamentals: Names and objects, conditional and unconditional looping, branching, functions, modules, packages, reading and writing data files, graphical output (plotting). Solving simple problems using a high level programming language to develop, code and debug programs. Solving complex problems by breaking it down into a number of simple problems using concepts such as functions, modules and available packages. Programming principles are developed through solving mathematics and physics problems.

Dynamics 210 (MSD 210)

Module credits 16.00

NQF Level 06

Prerequisites FSK 116 or FSK 176 and SWK 122 and WTW 256 #, admission to relevant programme

Contact time 2 tutorials per week, 3 lectures per week

Language of tuition Module is presented in English

Department Mechanical and Aeronautical Engineering

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
NQF Level	06
Prerequisites	FSK 116 or FSK 176, admission to relevant programme
Contact time	3 lectures per week, 1 practical per week, 2 tutorials per week
Language of tuition	Module is presented in English
Department	Mechanical and Aeronautical Engineering
Period of presentation	Semester 2

Module content

Application overview. Concepts: system, control mass, 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 control masses and control volumes. Conservation of mass. Processes: isothermal, polytropic, adiabatic, isentropic. Second law of thermodynamics and entropy for control masses and control volumes. Introduction to power cycles. Experimental techniques in thermodynamics.

Mathematics 238 (WTW 238)

Module credits	16.00
NQF Level	06
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	WTW 256 and WTW 258 GS
Contact time	1 tutorial per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
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
NQF Level	06
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	Module is presented in English
Department	Mathematics and Applied Mathematics
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.

Calculus 258 (WTW 258)

Module credits	8.00
NQF Level	06
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	WTW 158 and WTW 164
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
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
NQF Level	06
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	WTW 164
Contact time	2 lectures per week, 1 tutorial per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics

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.

Curriculum: Year 3

Minimum credits: 155

Core modules

Industrial analysis 313 (BAN 313)

Module credits	8.00
NQF Level	07
Prerequisites	BES 220
Contact time	3 lectures per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 1

Module content

Mathematical statistics provides the basis for several important applications in the engineering environment. This module provides an introduction to the most important of these applications using R programming. It will include the following syllabus themes: Reading and wrangling data, Data fusion, Regression, Basic data analysis and visualisation, Probability, Foundations for inference, Introduction to key statistical distributions, and Distribution fitting (use of probability distributions in modelling).

Supply chain technologies and project 321 (BFB 321)

Module credits	8.00
NQF Level	07
Prerequisites	(BOB 311) or (BLK 320)
Contact time	2 lectures per week, 1 practical per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 2

Module content

This module focuses on the technological integration and project-based application of supply chain engineering principles for industrial engineering students. The module provides students with the opportunity to apply their accumulated supply chain knowledge to develop comprehensive, technology-driven supply chain solutions. Emphasising practical, hands-on projects, students will design and prototype innovative supply chain systems and packaging solutions, preparing them for real-world industry challenges. Main themes covered in this module are: Supply chain technology overview; Advanced Technologies and System Integration; Project Development.

Information systems design 320 (BID 320)

Module credits	16.00
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NQF Level	07
Prerequisites	No prerequisites.
Contact time	3 lectures per week, 2 practicals per week, 1 tutorial per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
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.

Supply chain engineering 321 (BLK 321)

Module credits	16.00
NQF Level	07
Prerequisites	(BOB 311) or (BLK 320)
Contact time	4 lectures per week, 2 discussion classes per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 2

Module content

This module focuses on operations management and key activities, business processes and business decisions related to manufacturing operations and supply-side supply chain management. Main topics covered in this module are: Manufacturing planning and control; Aggregate planning and master production scheduling; Material requirements planning; Inventory management; Process selection and design; Product and service design; Strategic and operational capacity planning; Production activity control; Procurement strategies; Electronic procurement solutions and platforms; Procurement process for goods and services; Procurement pricing and price management; and South African government procurement policies and guidelines.

Supply chain engineering 311 (BOB 311)

Module credits	16.00
NQF Level	07
Prerequisites	No prerequisites.
Contact time	4 lectures per week, 2 discussion classes per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 1

Module content

This course introduces students to an integrated supply chain and exposes them to business logistics and strategic supply chain planning and management decisions. It also addresses key activities, business processes and decisions related to demand-side supply chain management. The main topics covered in this module are: Overview of supply chain management; Global dimensions of supply chains; supply chain strategy overview; Aligning and integrating the supply chain; Supply chain performance measurement; Supply chain sustainability; Supply chain reference models; Demand management; Order management and customer service; Distribution and network design; Logistics in supply chains; Transportation management; Warehousing operations and facility layout; and Material handling systems and equipment.

Operational research 312 (BOZ 312)

Module credits	16.00
NQF Level	07
Prerequisites	Admission to relevant programme
Contact time	2 discussion classes per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
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.

Practical training 310 (BPY 310)

Module credits	1.00
NQF Level	07
Prerequisites	No prerequisites.
Contact time	1 other contact session per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
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.

Business engineering 321 (BPZ 321)

Module credits	16.00
NQF Level	07
Contact time	2 tutorials per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 2

Module content

The purpose of this module is to introduce the students to a skillset that allows them to bridge the gap between business and engineering and thrive in today's dynamic business landscape. Themes include strategy formulation and analysis (e.g. Porter's five Forces, Blue Ocean Strategy, Scenario Planning), business model design, service design, financial feasibility, business planning, iterative design and prototyping, and operational excellence. Through engaging case studies and projects, students will not only develop an entrepreneurial mindset but also gain the ability to apply theoretical concepts to solve real-world challenges.

Engineering management 310 (BSS 310)

Module credits	8.00
NQF Level	07
Prerequisites	No prerequisites.
Contact time	3 lectures per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 1

Module content

The purpose of this module is to develop knowledge and understanding of engineering management principles and economic decision-making so that students can design, manage, evaluate and participate in engineering projects in the workplace. As such elements from engineering economics, project management and systems engineering are combined.

Simulation modelling 321 (BUY 321)

Module credits	16.00
NQF Level	07
Prerequisites	(BAN 313), admission to relevant programme
Contact time	6 lectures per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
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

NQF Level 05

Service modules Faculty of Engineering, Built Environment and Information Technology
Faculty of Natural and Agricultural Sciences

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

Contact time 3 lectures per week

Language of tuition Module is presented in English

Department 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.

Engineering activity and group work 320 (MIA 320)

Module credits 8.00

NQF Level 07

Prerequisites (CJJ 310) or (EJJ 210) or (BJJ 210) or (MJJ 210) or (NJJ 210) or (PJJ 210)

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

Language of tuition Module is presented in English

Department Mechanical and Aeronautical Engineering

Period of presentation Semester 2

Module content

Two exit-level Graduate Attributes (GAs) of ECSA are addressed and each must be passed in the same semester. GA7: 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. GA8: 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 teamwork: 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-worker's 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-worker's discipline. Students communicate between disciplinary boundaries.

Manufacturing systems 311 (MVS 311)

Module credits	16.00
NQF Level	07
Prerequisites	No prerequisites.
Contact time	3 lectures per week, 3 tutorials per week
Language of tuition	Module is presented in English
Department	Mechanical and Aeronautical Engineering
Period of presentation	Semester 1

Module content

Modern manufacturing processes including: Rapid Prototyping and Additive Manufacturing, Processing of integrated circuits, Electronics assembly and packaging, Micro-fabrication technologies and Nanofabrication technologies. Manufacturing technologies including Automated technologies for manufacturing systems, Integrated Manufacturing systems, Process planning and production control as well as Quality control and inspection topics.

Curriculum: Final year

Minimum credits: 151

Core modules

Labour relations 320 (ABV 320)

Module credits	20.00
NQF Level	07
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Humanities Faculty of Natural and Agricultural Sciences
Prerequisites	No prerequisites.
Contact time	3 lectures per week
Language of tuition	Module is presented in English
Department	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.

Business law 310 (BER 310)

Module credits	10.00
NQF Level	07
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	Admission to the relevant programme.
Contact time	4 lectures per week
Language of tuition	Module is presented in English
Department	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.

Quality assurance 410 (BGC 410)

Module credits	16.00
NQF Level	08
Prerequisites	No prerequisites.
Contact time	4 lectures per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
Period of presentation	Semester 1

Module content

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

Engineering economics 420 (BIE 420)

Module credits	8.00
NQF Level	08
Prerequisites	No prerequisites.
Contact time	1 discussion class per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
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.

Operational research 410 (BON 410)

Module credits	16.00
NQF Level	08
Prerequisites	(BES 220), (BOZ 312), admission to relevant programme
Contact time	2 tutorials per week, 4 lectures per week

Language of tuition Module is presented in English

Department Industrial and Systems Engineering

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. Forecasting: time series problems, different methods of forecasting. Introduction to Neural Network, supervised and unsupervised learning, selected network types and learning rules. Introduction to fuzzy logic and membership function, fuzzy operations and relations, fuzzy applications in Industrial Engineering.

Project 410 (BPJ 410)

Module credits 16.00

NQF Level 08

Prerequisites Finalists only, admission to relevant programme

Contact time 1 other contact session per week

Language of tuition Module is presented in English

Department Industrial and Systems Engineering

Period of presentation Semester 1

Module content

Choice of project topic. Appointment of project leader. Literature study, analysis and selection of techniques for project approach.

Project 420 (BPJ 420)

Module credits 24.00

NQF Level 08

Prerequisites BPJ 410, admission to relevant programme

Contact time 1 other contact session per week

Language of tuition Module is presented in English

Department Industrial and Systems Engineering

Period of presentation Semester 2

Module content

Narrowing of solution choice. Detailed solution development and evaluation of the chosen alternative. Writing of the final project report and presentation of the project using a poster and oral presentation.

Practical training 410 (BPY 410)

Module credits 1.00

NQF Level	08
Prerequisites	No prerequisites.
Contact time	1 other contact session per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
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.

Management accounting 410 (BSR 410)

Module credits	16.00
NQF Level	08
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	FBS 110
Contact time	6 lectures per week
Language of tuition	Module is presented in English
Department	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. Pricing products and services.

Systems engineering 410 (BSS 410)

Module credits	16.00
NQF Level	08
Prerequisites	No prerequisites.
Contact time	1 discussion class per week, 3 lectures per week
Language of tuition	Module is presented in English
Department	Industrial and Systems Engineering
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
NQF Level	08
Prerequisites	No prerequisites.
Contact time	2 lectures per week, 1 other contact session per week
Language of tuition	Module is presented in English
Department	Mining Engineering
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.

General Academic Regulations and Student Rules

The [General Academic Regulations \(G Regulations\)](#) and [General Student Rules](#) apply to all faculties and registered students of the University, as well as all prospective students who have accepted an offer of a place at the University of Pretoria. On registering for a programme, the student bears the responsibility of ensuring that they familiarise themselves with the General Academic Regulations applicable to their registration, as well as the relevant faculty-specific and programme-specific regulations and information as stipulated in the relevant yearbook. Ignorance concerning these regulations will not be accepted as an excuse for any transgression, or basis for an exception to any of the aforementioned regulations. The G Regulations are updated annually and may be amended after the publication of this information.

Regulations, degree requirements and information

The faculty regulations, information on and requirements for the degrees published here are subject to change and may be amended after the publication of this information.

University of Pretoria Programme Qualification Mix (PQM) verification project

The higher education sector has undergone an extensive alignment to the Higher Education Qualification Sub-Framework (HEQSF) across all institutions in South Africa. In order to comply with the HEQSF, all institutions are legally required to participate in a national initiative led by regulatory bodies such as the Department of Higher Education and Training (DHET), the Council on Higher Education (CHE), and the South African Qualifications Authority (SAQA). The University of Pretoria is presently engaged in an ongoing effort to align its qualifications and programmes with the HEQSF criteria. Current and prospective students should take note that changes to UP qualification and programme names, may occur as a result of the HEQSF initiative. Students are advised to contact their faculties if they have any questions.