University of Pretoria Yearbook 2025

BEng in Computer Engineering 4-year programme (12130019)

Department	Electrical, Electronic and Computer Engineering
Minimum duration of study	4 years
Total credits	590
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:

a. Engineering problem solving.
b. Application of specialist and fundamental knowledge, with specific reference to mathematics, basic sciences and engineering sciences.
c. Engineering design and synthesis.
d. Investigation, experimentation and data analysis.
e. Engineering methods, skills, tools and information technology.
f. Professional and general communication.
g. Awareness and knowledge of the impact of engineering activity on society and the physical environment.
h. Work in teams and in multidisciplinary environments.
i. An awareness and ability for lifelong learning.
j. An awareness and knowledge of principles of professional ethics and practice.
k. 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:

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

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

Admission requirements

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 Bachelor of Engineering in Computer Engineering are Bachelor of Science in Chemistry, Bachelor of Science in Mathematics and Bachelor of Science in Physics.

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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

Program design: Introduction 110 (COS 110)

Module credits	16.00
NQF Level	05
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	COS 132 AND (COS 151 OR 12130009 OR 12136009) AND Maths level 5
Contact time	3 lectures per week, 1 practical per week, 1 tutorial per week
Language of tuition	Module is presented in English
Department	Computer Science
Period of presentation	Semester 2

Module content

The focus is on object-oriented (OO) programming. Concepts including inheritance and multiple inheritance, polymorphism, operator overloading, memory management (static and dynamic binding), interfaces, encapsulation, reuse, etc. will be covered in the module. The module teaches sound program design with the emphasis on modular code, leading to well structured, robust and documented programs. A modern OO programming language is used as the vehicle to develop these skills. The module will introduce the student to basic data structures, lists, stacks and queues.

Operating systems 122 (COS 122)

Module credits	16.00
NQF Level	05
Prerequisites	COS 132, admission to relevant programme
Contact time	1 practical per week, 1 tutorial per week, 3 lectures per week
Language of tuition	Module is presented in English

Department	Computer Science
Period of presentation	Semester 2

Module content

Fundamental concepts of modern operating systems in terms of their structure and the mechanisms they use are studied in this module. After completing this module, students will have gained, as outcomes, knowledge of real time, multimedia and multiple processor systems, as these will be defined and analysed. In addition, students will have gained knowledge on modern design issues of process management, deadlock and concurrency control, memory management, input/output management, file systems and operating system security. In order to experience a hands-on approach to the knowledge students would have gained from studying the abovementioned concepts, students will have produced a number of practical implementations of these concepts using the Windows and Linux operating systems.

Imperative programming 132 (COS 132)

Module credits	16.00
NQF Level	05
Service modules	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	APS of 30 and level 5 (60-69%) Mathematics
Contact time	1 tutorial per week, 1 practical per week, 3 lectures per week
Language of tuition	Module is presented in English
Department	Computer Science
Period of presentation	Semester 1

Module content

This module introduces imperative computer programming, which is a fundamental building block of computer science. The process of constructing a program for solving a given problem, of editing it, compiling (both manually and automatically), running and debugging it, is covered from the beginning. The aim is to master the elements of a programming language and be able to put them together in order to construct programs using types, control structures, arrays, functions and libraries. An introduction to object orientation will be given. After completing this module, the student should understand the fundamental elements of a program, the importance of good program design and user-friendly interfaces. Students should be able to conduct basic program analysis and write complete elementary programs.

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).

Information technology practice 121 (EIW 121)

Module credits	1.00
NQF Level	05
Prerequisites	No prerequisites.
Contact time	2 weeks
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Year

Module content

This module is offered during the recess period at the end of the first year of study. In this module students receive practical training in computers and computer networks. Students will be informed by the Department if, for practical reasons, the module needs to be offered in a different time slot.

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.

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.

Curriculum: Year 2

Minimum credits: 156

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.

Data structures and algorithms 212 (COS 212)

Module credits	16.00
NQF Level	06
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	COS 110, admission to relevant programme
Contact time	4 lectures per week, 1 practical per week
Language of tuition	Module is presented in English
Department	Computer Science
Period of presentation	Semester 1

Module content

Data abstraction is a fundamental concept in the design and implementation of correct and efficient software. In prior modules, students are introduced to the basic data structures of lists, stacks and queues. This module continues with advanced data structures such as trees, hash tables, heaps and graphs, and goes into depth with the algorithms needed to manipulate them efficiently. Classical algorithms for sorting, searching, traversing, packing and game playing are included, with an emphasis on comparative implementations and efficiency. At the end of this module, students will be able to identify and recognise all the classical data structures; implement them in different ways; know how to measure the efficiency of implementations and algorithms; and have further developed their programming skills, especially with recursion and polymorphism.

Electrical engineering 211 (EIR 211)

Module credits	16.00
NQF Level	06
Prerequisites	EBN 111 or EBN 122 and WTW 164 and admission into 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

Transient response phenomena in RC, RL and RLC circuits: Natural response and step response. Alternating current (AC) circuits: Phasors, impedances, and power in AC circuits. The application of Ohm’s law, Kirchoff’s circuit theorems, matrix methods and Thevenin and Norton equivalents to sinusoidal steady-state analysis. Three-phase circuits: Balanced three-phase circuits, star/delta configurations, and three-phase power transfer calculations. Magnetically coupled circuits: Mutual inductance, coupling factor, transformers, ideal transformers and autotransformers. Application of circuit theory to an induction machine: basic principles of induction machines, equivalent circuit and analysis thereof, calculation of power and torque through application of Thevenin's theorem. Synoptic introduction to other types of machines.

Information technology practice 221 (EIW 221)

Module credits	8.00
NQF Level	06
Prerequisites	EIW 121
Contact time	2 weeks
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Year

Module content

This module is offered during the recess period at the end of the second year of study. In this module students receive practical training in computers and computer networks. Students will be informed by the Department if, for practical reasons, the module needs to be offered in a different time slot.

Professional and technical communication 210 (EJJ 210)

Module credits	8.00
NQF Level	06
Prerequisites	No prerequisites.
Contact time	2 tutorials per week, 2 lectures per week
Language of tuition	Module is presented in English

Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 1

Module content

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

Linear systems 220 (ELI 220)

Module credits	16.00
NQF Level	06
Prerequisites	EIR 211/221 GS and admission into relevant programme.
Contact time	1 tutorial per week, 9 hours practical per semester, 3 lectures per week
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 2

Module content

This module presents an introduction to linear systems (classification of signals, elementary signal properties, signal operations and system equations), time-domain models of linear systems (impulse response, LTI responses, convolution of continuous-time signals and related properties), Fourier series (exponential and trigonometric Fourier series, Euler, amplitude and phase spectra, bandwidth, Gibbs phenomenon, Parseval's theorem and Dirichlet condition), the Fourier transform (Fourier transform and its inverse, properties, introduction to modulation systems (amplitude modulation), energy and power spectral density of continuous-time signals), the Laplace transform (relationship with Fourier, properties, transform pairs, integro-differential equations of RC, RL and RLC circuits, block diagrams, poles and zeros, Bode plots, second-order system properties, stability, final and initial value theorems, natural frequency, natural and forced response, step response and sinusional input analysis), filter design (ideal filters and practical filter design (lowpass, highpass, bandpass and bandstop) and Butterworth and other filter designs), and sampling and quantisation (sampling theorem and Nyquist criteria, aliasing, introduction to anti-aliasing filters and digital systems).

Introduction to programming and computer simulations 201 (EMR 201)

Module credits	4.00
NQF Level	06

Prerequisites	No prerequisites.
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Year

Module content

This module is presented during the recess period at the end of the first semester. The module serves as an introduction to programming and computer simulations using a high-level industry-standard programming language to develop and support problem solving. Students will be informed by the Department if, for practical reasons, the module needs to be offered in a different time slot.

Digital systems 220 (ERS 220)

Module credits	16.00
NQF Level	06
Prerequisites	No prerequisites.
Contact time	9 hours practical per semester, 3 lectures per week, 1 tutorial per week
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 2

Module content

This module presents an introduction to digital circuit design (digital representations of numbers, device electronics in digital circuits, representation and simplification of logic functions), components of combinational circuits, including analysis and design of combinational circuits, components of sequential circuits, including analysis and design of sequential circuits, and datapath components and register-transfer level design. Programmable components and hardware description language are considered throughout.

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.

Materials science 113 (NMC 113)

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 1

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.

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: 152

Core modules

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.

Intelligent systems 320 (EAI 320)

Module credits	16.00
NQF Level	07
Prerequisites	WTW 258 GS and admission into 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 module is an introduction to problem-solving and pattern recognition using intelligent systems. Application of basic artificial intelligence (AI) and machine learning (ML) techniques including search, genetic algorithms, neural networks, probabilistic reasoning, and supervised learning are covered.

Control systems 320 (EBB 320)

Module credits	16.00
NQF Level	07
Prerequisites	ELI 220 GS and admission into relevant programme.
Contact time	9 hours practical per semester, 3 lectures per week, 1 tutorial per week

Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 2

Module content

The module covers modelling in the frequency and time domain, time and frequency response, reduction of multiple subsystems, stability, controller design via root locus, controller design via frequency response and controller design via state space.

Digital communication 310 (EDC 310)

Module credits	16.00
NQF Level	07
Prerequisites	ELI 220 GS and admission into relevant programme.
Contact time	9 hours practical per semester, 3 lectures per week, 1 tutorial per week
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 2

Module content

In this module, skills are developed which will enable the students to understand the fundamentals of analogue and digital communication systems, analyse existing systems, improve and modify existing services if required, and design and develop new communication equipment and systems that will meet future demands. Topics that are covered in this module are an introduction to digital communication systems, source coding, communication through an additive white Gaussian channel, carrier modulation, single- and multi-carrier communication through a multipath channel, error-correction coding, and multi-user communication.

Information technology practice 320 (EIW 320)

Module credits	8.00
NQF Level	07
Prerequisites	EIW 221 and admission into relevant programme.
Contact time	2 weeks
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Year

Module content

This module is offered during the recess period at the end of the third year of study. In this module students receive practical training in computers and computer networks. Students will be informed by the Department if, for practical reasons, the module needs to be offered in a different time slot.

Electromagnetic compatibility 310 (EME 310)

Module credits	16.00
NQF Level	07
Prerequisites	No prerequisites.
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 module is aimed at providing computer engineering students with a background in electromagnetism and electromagnetic compatibility. Introduction: nature of electric and magnetic fields, electromagnetic spectrum, complex numbers and phasors, coordinate systems (cartesian, cylindrical, spherical). Transmission lines: lumped element model, transmission line equations, travelling versus standing waves, lossless lines, input impedance, short and open-circuited and λ/4 lines, power flow, transients on transmission lines, S-parameters. Electrodynamic fields: Maxwell's equations, plane waves in unbounded media, power density, plane waves normally incident on an interface between materials, Faraday's law. Antennas: impedance, radiation patterns, directivity, gain. Electromagnetic compatibility (EMC): sources of interference, non-ideal behaviour of passive circuit elements, EMC effects of digital signals, grounding techniques, good printed circuit layout practice, far-field shielding, power supply decoupling, ground loops, differential mode and common mode radiation, cable shielding.

Microprocessors 310 (EMK 310)

Module credits	16.00
NQF Level	07
Prerequisites	ERS 220 GS, ELI 220 GS, ENE 310/ ENE 310# and admission into relevant programme.
Contact time	9 hours practical per semester, 1 tutorial per week, 3 lectures per week
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 1

Module content

The module provides a project-based introduction to embedded design. General microprocessor architecture and firmware development are explored with a specific focus on memory and address decoding, general embedded programming principles, microprocessor input/output and interfacing with the real world, and the functioning and application of peripheral devices such as timers, ADCs, serial communication ports and PWM. Embedded design tools are introduced through the use of a microcontroller development board and integrated development environment (IDE) that serve as the primary learning platform. Students are exposed to current and new trends in the microcontroller industry.

Analogue electronics 310 (ENE 310)

Module credits	16.00
NQF Level	07
Prerequisites	ELI 220 GS and admission into 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

Operational amplifiers: non-idealities and limitations. Amplifier concepts: two-port modelling, gain, input and output impedance, cascaded amplifiers, signal-to-noise ratio, total harmonic distortion, power dissipation and power efficiency, frequency response and bandwidth. Feedback and stability in amplifiers. Linear operational circuits: transducers and amplifiers, instrumentation amplifiers, filters and impedance converter amplifiers. Non-linear operational circuits: oscillators, rectifiers, Schmitt triggers, peak detectors, track-and-hold amplifiers, amplifiers with non-linear transfer functions. Sampling electronics: signal quantisation, DA and AD converter circuits.

Software engineering 321 (EPE 321)

Module credits	16.00
NQF Level	07
Prerequisites	COS 212 and admission into relevant programme.
Contact time	1 tutorial per week, 9 hours practical per semester, 3 lectures per week
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 2

Module content

Software engineering deals with the application of engineering principles to develop and maintain high-quality software that is reliable and that works efficiently. Software engineering includes defining software requirements and performing software design, software construction, software testing, and software maintenance tasks. The module exposes students to various methodologies in the different stages of the software life cycle, the problems of group work, and software configuration management through versioning systems. The student is exposed to object modelling techniques and languages such as UML, as well as debugging and testing techniques.

Computer engineering design 320 (ERD 320)

Module credits	16.00
NQF Level	07
Prerequisites	EMK 310 GS and admission into relevant programme.

Contact time	2 lectures per week, 1 tutorial per week, 18 hours practical per semester
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 2

Module content

In this module, students are required to generate a creative system design through synthesis and integration of components and subsystems. Students have to acquire technical knowledge through independent learning, and demonstrate a competency to work in a technical design team to realise and demonstrate a working product. This practical component is augmented by theoretical instruction in the fundamentals of system engineering, industry standards and practices, PCB layout techniques, and packaging technology.

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.

Curriculum: Final year

Minimum credits: 137

Core modules

Computer engineering: Architecture and systems 410 (EAS 410)

Module credits	16.00
NQF Level	08
Prerequisites	EMK 310 GS and admission into relevant programme.
Contact time	3 lectures per week, 9 hours practical per semester, 1 tutorial per week
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 1

Module content

The module covers advanced topics in computer architecture and systems, in particular, multiprocessors, parallelisms, performance measurement of computer systems, scheduling, data routing mechanisms, efficiency, and hierarchical memory technology. In addition, quality of parallelism, system efficiency, speedup, and linear and non-linear pipelines technologies are investigated to gain deeper insight into the computer system architecture.

e-Business and network security 410 (EHN 410)

Module credits	16.00
NQF Level	08
Prerequisites	No prerequisites.
Contact time	1 tutorial per week, 9 hours practical per semester, 3 lectures per week
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 1

Module content

The overall objectives of the module are to address the fundamental issues of (i) threats to the security of a system, posed by adversaries and malicious parties, (ii) the services required by users of a secure system, and (iii) the mechanisms to counter these threats. More specifically, this module covers computer and network security concepts, number theory, block cyphers and the data encryption standard, finite fields, advanced encryption standard, block cypher operation, random bit generation and stream cyphers, public-key cryptography and RSA, cryptographic hash functions, message authentication codes, digital signatures, key management and distribution, user authentication, network access control and cloud security, transport-level security, wireless network security, electronic mail security, and IP security.

Project 402 (EPR 402)

Module credits	64.00
NQF Level	08
Prerequisites	ERD 320 Finalists only and admission into relevant programme.
Contact time	1 lecture per week
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Year

Module content

This module entails the individual completion of a major engineering design project from concept to delivery. The student has to demonstrate the ability to develop a project concept into a completed final product that meets given requirements. The module focuses on the formulation of an engineering problem, the development of appropriate technical requirements and specifications (captured in a formal project proposal), project planning, design, implementation, verification that requirements are met, and completion of a technical project of a given nature, scope and complexity. The module requires the student to perform engineering design from first principles. At project completion, the student has to validate the actual design performance in real-world conditions against the design requirements and specifications. The design and results are documented in a major technical report, and the work is defended at a final oral examination and demonstration.

Practical training and report 423 (EPY 423)

Module credits	1.00
NQF Level	08
Prerequisites	No prerequisites.
Contact time	1 lecture per week
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 2

Module content

Four weeks practice-orientated experience at any institution of the student’s choice (preferably in electrical, electronic or computer engineering). The student must acquire experience in the working environment and more specifically work ethics, ecology, economy, punctuality, knowledge of human nature, etc. One week after the commencement of the second semester the student must submit a report on the aspects of his/her work experience as determined by the Head of the Department.

Research project 420 (ERP 420)

Module credits	16.00
NQF Level	08
Prerequisites	First-time concurrent registration with EPR 402.

Contact time	18 hours practical in Quarter 1 and Quarter 3, 2 lectures per week in Quarter 1 and Quarter 3, 1 tutorial per week in Quarter 1 and Quarter 3
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Year

Module content

Specific niche areas from computer engineering are addressed within the context of a research project. The student should be able to demonstrate competence in designing and conducting investigations and experiments; to analyse the results; to select and use appropriate engineering tools and software; to interpret and derive information from the data; to draw conclusions based on evidence and to communicate the purpose, process and outcomes in a report.

DSP programming and application 411 (ESP 411)

Module credits	16.00
NQF Level	08
Prerequisites	ESC 320 GS or EDC 310 GS and admission into relevant programme.
Contact time	3 lectures per week, 9 hours practical per semester, 1 tutorial per week
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 1

Module content

This module addresses basic principles of DSP (basic DSP system architecture and properties, analogue interfaces), discrete transforms (Fourier series, Discrete Fourier-Transform (DFT), Fast Fourier-Transform (FFT) and Z-transform), correlation and convolution (correlation, convolution, properties and applications, DSP implementation), digital filters (design framework, FIR and IIR filter design, introduction to adaptive filters), DSP hardware (computer architecture and DSP processors, mapping of DSP algorithms onto DSP hardware), real-world applications and design studies, and simulation (in C) and real-time implementation of selected signal processing algorithms on DSP hardware.

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.