UNIVERSITY OF ZULULAND

FACULTY OF SCIENCE AND AGRICULTURE

PROFESSIONAL ENGINEERING DEGREE PROSPECTUS

BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING

BACHELOR OF ENGINEERING IN MECHANICAL ENGINEERING

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Introduction and Overview

This brochure should be read in conjunction with the 2021 undergraduate handbook for the Faculty of Science and Agriculture for the Faculty and University rules. The brochure contains curriculum and information specific to the professional engineering degree programmes.

Qualifications

From 2021 the faculty will offer two 4-year professional engineering degrees. The degrees have been accredited by the Council of Higher Education (CHE) and registered with the South African Qualifications Authority (SAQA). They have received a Letter of Endorsement from the Engineering council of South Africa (ECSA) and they will be accredited by ECSA as part of the Washington Accord international accreditation process.

The following 4-year engineering degrees will be offered from 2021:

- Bachelor of Engineering in Electrical Engineering
- Bachelor of Engineering in Mechanical Engineering

Career Opportunities

The Bachelor of Engineering in Electrical Engineering and the Bachelor of Engineering in Mechanical Engineering are undergraduate degrees which will increase the number of people with high level skills in our society. This will assist in expanding the South African economy, and will create employment opportunities. The two qualifications will provide opportunities for students with a suitable mathematics background to move towards acquiring an internationally accredited degree from UNIZULU as a member of the Washington Accord professional qualifications. This will enable those who achieve these qualifications to benefit from opportunities that arise within South Africa, throughout the rest of Africa and worldwide.

Meaning of Terms Used

Module Unit of study. Each such unit is given a code. The code structure is as follows:

Faculty Indicator (4 = Science and Agriculture, 5 = Engineering and the Built Environment)

Three Letters, Discipline Indicator:
(EEE = Electrical, Electronic and Computer Engineering, MEC = Mechanical Engineering)

Year of Study : A student will be deemed to be in:

- The First year of study if s/he has not yet obtained a minimum of 108 degree credit points;
- Second year of study if s/he has obtained at least 108 degree credit points but has not yet obtained 50% of the credits needed for the qualification;
- Third year of study if s/he has obtained at least 50% of the degree credits needed for the qualification;
- Fourth year of study if s/he has registered for such modules which, if passed, will
  lead to the completion of the degree.

Curriculum Design/ Mode of delivery

(a) An academic year is made up of a number of modules, each having a credit rating based on the number of lectures, practicals, tutorials and other related learning activities. A semester-long module is typically worth 16 credit points.
(b) These two 4-year engineering programmes are 576 credit points each. A student normally takes 144 credit points per year.
(c) The first year of the Electrical Engineering degree curriculum and the Mechanical Engineering degree curriculum are identical. Students can transfer from one degree to the other at the end of the first year.
(d) The Mechanical Engineering degree is a fixed four-year curriculum. The Electrical Engineering degree is fixed for the first three years and students can elect to register for either two Power Engineering major modules in the final year or one Power Engineering module plus one Telecommunications module.
(e) Some modules have prerequisites and/or co-requisite requirements. These are listed under Syllabi below.
(f) The content may be delivered face –to – face using the traditional classroom structure or virtually using an on online platform. Students further need to have compatible devices in order to participate in all virtual learning platforms and activities.

Entry Requirements

Please note that the achievement of the minimum requirements for admission does not guarantee an applicant admission into the Electrical Engineering or Mechanical Engineering degree programmes.

Minimum Entry Requirements

Electrical Engineering or Mechanical Engineering
(a) A National Senior Certificate (NSC) with passes allowing entry to degree studies is required. (NSC-Degree) or its approved foreign equivalent.
(b) A minimum of 30 NSC points.
(c) A pass of at least 65% (level 5) in Mathematics.
(d) A pass of at least 50% (level 4) in English Home Language or English First Additional Language.
(e) A pass of at least 60% (level 5) in Physical Sciences.

Under the old (pre 2008) matriculation system (Higher grade and Standard grade)
(a) Matric Exemption
(b) A minimum of 30 Matric points
(c) English HG D or SG C (English Home Language or English First Additional Language.
(d) Mathematics HG C or SG A
(e) Physical Science HG D or SG B

Exclusion Rules

Students who fail to obtain the minimum number of credits at the end of each semester, as tabulated below, and are unable to propose an academic plan acceptable to the Dean to address their slow progress, shall be excluded from the Faculty.

(a) The number of semesters spent in other universities or faculties may be used in the calculations below.
(b) The University General rules apply for any appeals of exclusion

Semester	Credits
1 2	32 72
3 4	108 160
5 6	192 252 *(108 at 2nd year level)*
7 8	288 352 *(64 at 3rd year level)*
9 10	378 432 *(108 at 3rd year level)*
11 12	504 576 **(qualification complete)**

Curriculum

The curriculum for the common first year for the BEng Electrical Engineering degree and the BEng Mechanical Engineering is shown in the table below:

Module Code	Module name	NQF Level	Credit Value	Prerequisite Subject(s)
	Year 1 Semester 1			
4MTH171	Calculus I for Engineers	5	16	
4PHY171	General Physics A for Engineers	5	16	
4MTH181	Engineering Mechanics	5	16	
4CPS171	Introductory Computing for Engineers	5	16	
5MEC111	Engineering Drawing	5	8	
Total			**72**	
Module Code	**Module Name**	**NQF Level**	**Credit Value**	**Prerequisite Subject(s)**
	Year 1 Semester 2			
4MTH172	Calculus II for Engineers	5	16	4MTH171
4PHY172	General Physics B for Engineers	5	16	4PHY171
5EEE112	Introduction to Engineering	5	16	4MTH171
4CHM172	General Chemistry for Engineers	5	16	
5MEC112	Introduction to Engineering Design	5	8	5MEC111

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The curriculum for the second year, the third year and the fourth year of the BEng Electrical Engineering is shown in the table below:

Module Code	Module Name	NQF Level	Credit Value	Prerequisite Subject(s)
	Year 2 Semester 1			
4MTH271	Advanced Calculus for Engineers	6	16	4MTH172
5EEE211	Embedded Systems I	6	16	5EEE112
5EEE221	Signals and Systems I	6	16	5EEE112
5EEE231	Analogue Electronic Design	6	16	5EEE112
5EEE241	Professional Communications	6	8	ALL FIRST YEAR MODULES
Module Code	**Module Name**	**NQF Level**	**Credit Value**	**Prerequisite Subject(s)**
	Year 2 Semester 2			
4MTH272	Linear Algebra and Differential Equations for Engineers	6	16	4MTH172
4PHY272	Electromagnetism for Engineers	6	16	4PHY171, 4PHY172
5EEE212	Introduction to Power Engineering	6	16	5EEE112
4CPS172	Introduction to Programming for Engineers	5	16	4CPS171
5MEC242	Project Management	6	8	ALL FIRST YEAR MODULES
Module Code	**Module Name**	**NQF Level**	**Credit Value**	**Prerequisite Subject(s)**
	Year 3 Semester 1			
5EEE311	Electromagnetic Engineering	7	12	4PHY272, 4MTH271
5EEE321	Electronic Devices and Circuits	7	16	5EEE231
5EEE331	Energy Conversion	7	16	5EEE212
5EEE341	Signals and Systems II	7	16	5EEE221
4STA171	Statistics for Engineers	7	12	

Module Code	Module Name	NQF Level	Credit Value	Prerequisite Subject(s)
	Year 3 Semester 2			
5EEE312	Control Engineering	7	16	4MTH272, 5EEE231
5EEE322	Power Systems	7	16	5EEE212
5EEE332	Communications and Networks	7	16	5EEE231
1ANT172	Culture and Society in Africa	5	16	
5EEE342	Electrical Engineering Design and research methods	7	8	5EEE321, 5EEE331, 5EEE341
Module Code	**Module Name**	**NQF Level**	**Credit Value**	**Prerequisite Subject(s)**
	Year 4 Semester 1			
5EEE411	Process Control and Instrumentation	8	16	5EEE312
5EEE421	Engineering Systems Design	8	16	5EEE342
5MEC451	Engineering Professionalism	8	8	ALL THIRD YEAR MODULES
	Select 2 from the following 3			
5EEE431	Power Electronics & Machines	8	16	5EEE331
5EEE441	Power Systems Engineering	8	16	5EEE322
5EEE451	Telecommunications	8	16	5EEE332
Module Code	**Module Name**	**NQF Level**	**Credit Value**	**Prerequisite Subject(s)**
	Year 4 Semester 2			
5EEE412	Professional Communication Studies	8	8	5EEE241
5EEE422	New Venture Planning and Management	8	8	ALL THIRD YEAR MODULES
5MEC442	Industrial Ecology	8	8	ALL THIRD YEAR MODULES
2LMA472	Maritime Law for Engineers	8	8	ALL THIRD YEAR MODULES
5EEE432	Final Year Research Project	8	40	
	TOTAL CREDITS FOR THE DEGREE		**576**	

The curriculum for the second year, the third year and the fourth year of the BEng Mechanical Engineering is shown in the table below:

Module Code	Module Name	NQF Level	Credit Value	Prerequisite Subject(s)
	Year 2 Semester 1			
4MTH271	Advanced Calculus for Engineers	6	16	4MTH172
5EEE231	Analogue Electronic Design	6	16	5EEE112
5EEE221	Signals and Systems I	6	16	5EEE112
5MEC211	Mechanics of Solids I	6	12	4MTH172, 4MTH182
5MEC221	Materials Science in Engineering	6	12	4MTH172, 4MTH182
Module Code	**Module Name**	**NQF Level**	**Credit Value**	**Prerequisite Subject(s)**
	Year 2 Semester 2			
4MTH272	Linear Algebra and Differential Equations for Engineers	6	16	4MTH172
5MEC212	Thermofluids I	6	12	4MTH172, 4MTH182
5MEC222	Dynamics I	6	16	4MTH172, 4MTH182
5MEC232	Mechanical Engineering Machine Element Design I	6	12	5MEC112, 5MEC122
5EEE212	Introduction to Power Engineering	6	16	5EEE112
Module Code	**Module Name**	**NQF Level**	**Credit Value**	**Prerequisite Subject(s)**
	Year 3 Semester 1			
5MEC311	Mechanics of solids II	7	12	5MEC211
5MEC321	Thermofluids II	7	20	5MEC212
5MEC331	Mechanical Engineering Machine Element Design II	7	8	5MEC232
4STT171	Statistics for Engineers	5	12	
5MEC341	Experimental Methods	7	12	ALL SECOND YEAR MODULES
5MEC351	Materials under Stress	7	8	5MEC221

Module Code	Module Name	NQF Level	Credit Value	Prerequisite Subject(s)
	Year 3 Semester 2			
5MEC312	Mechanical Engineering Machine Element Des III	7	12	5MEC331
5MEC322	Dynamics II	7	16	5MEC222
5MEC332	Thermofluids III	7	12	5MEC321
5MEC242	Project Management	6	8	ALL SECOND YEAR MODULES
5MEC342	Professional Communication Studies	7	8	ALL SEOND YEAR MODULES
1ANT172	Culture and Society in Africa	5	16	
Module Code	**Module Name**	**NQF Level**	**Credit Value**	**Prerequisite Subject(s)**
	Year 4 Semester 1			
5MEC411	Mechanical Vibrations	8	12	5MEC322
5MEC421	Product Design	8	12	5MEC312
5MEC431	Finite Element Analysis	8	12	5MEC311
5MEC461	Industrial Ecology	8	12	ALL THIRD YEAR MODULES
5MEC441	Fundamentals of Control Systems	8	12	ALL THIRD YEAR MODULES
5MEC471	Engineering Professionalism	8	12	
Module Code	**Module Name**	**NQF Level**	**Credit Value**	
	Year 4 Semester 2			
5MEC412	System Design	8	12	5MEC421
5MEC432	Final Year Research Project	8	40	
5MEC422	New Venture Planning and Management	8	12	ALL THIRD YEAR MODULES
2LMA472	Maritime Law for Engineers	8	8	ALL THIRD YEAR MODULES
	TOTAL CREDITS FOR THE DEGREE		**576**	

Degree Module Content First Year (Shared first year modules for Electrical Engineering and Mechanical Engineering)

Title	**Calculus I for Engineers**		
Code	**4MTH171**	**Department**	**Mathematical Sciences**
Prerequisites	**None**	**Co-requisites**	**None**
Aim	To introduce differential calculus with necessary prerequisites from logic and general algebra.		
Content	• Elementary Logic and Theory of Sets: sets and subsets, Venn-Euler diagrams, basic set operations, sets of numbers, elementary logic. • Inequalities: Definition, order axioms, interval notation, set builder notation, solving inequality equations. Absolute value • Functions: elementary functions, graph of a function, combination of functions, inverse functions, exponential and logarithmic functions, relations. • Limits, Continuity and Differentiation: definition of limit, continuity and the derivative • Algebra: induction, vectors and vector algebra, dot products and cross products, introduction to matrices and matrix algebra, transpose and determinants, the adjoint matrix, invertible matrix and Cramer's rule, complex numbers and De Moivre's theorem.		
Assessment	40% Continuous Assessment Mark 60% Formal end of module exam (3 hours)		
DP Requirement	40% Continuous Assessment Mark 80% Attendance at lectures and tutorials.		

Title	**Classical Mechanics and Properties of Matter for Engineers**		
Code	**4PHY171**	**Department**	**Physics and Engineering**
Prerequisites	**None**	**Co-requisites**	**None**
Aim	The module is meant for entry level BEng and contains fundamental concepts in Physics and Engineering that prepares the student for later study in more advanced fields in the Physical Sciences. It contains basic concepts in mechanics, waves, optics and thermodynamics.		
Content	• Statistical concepts: Probability, distributions, histograms, standard deviation, propagation of errors. Units and measurement: Dimensions, SI-system of units, basic measurements in physics. • Mechanics: Forces, moments, couples, Newton's laws, circular motion, momentum, oscillations, momentum and impulse. • Heat and thermodynamics: Mechanisms of heat transfer, heat capacity, phase changes, gases. • Waves: Sound waves, light and light sources, laws of refraction, diffraction and reflection. • Practical: Laboratory sessions on precision calculations in experimental results, forces, mechanics, optics heat and properties of matter.		
Outcomes	▪ An understanding of statistical concepts for data analysis and presentation. ▪ An understanding of basic mechanics concepts, laws of Newton and their practical application. ▪ The understanding of circular motion, its mathematical representation and solving of problems associated with repetitive circular motion. ▪ An understanding of wave concepts, modes of propagation and associated phenomena inside a material medium. ▪ Problems. ▪ Learners should be able to identify most of laboratory instruments used in the level 1 laboratory and use these properly to obtain meaningful results. ▪ Learners must be able to write simple scientific reports commensurate with level 1 B.Sc.		
Assessment	40% Continuous Assessment Mark 60% Formal end of module exam (3 hours)		
DP Requirement	40% Continuous Assessment Mark 80% Attendance at practical's and Project work		

Title	Introductory Computing for Engineers		
Code	**4CPS171**	**Department**	**Computer Science**
Prerequisites	**None**	**Co-requisites**	**Any Mathematics module**
Aim	**To provide an introduction to hardware and software components of computer**		
Content	**Section A – Computer Architecture** Introduction to Digital logic and Digital systems; Machine level representation of data; Assembly level machine organization **Section B – Software Development Fundamentals** Fundamental Programming concepts and Object-Oriented Programming		
Outcomes	At the end of the module, the learners should be able to: ▪ Explain the organization of the classical von Neumann machine and its major functional units. ▪ Describe the internal representation of data. ▪ Represent Boolean logic problems as: truth tables and logic circuits. ▪ Design, implement, test, and debug programs that use fundamental programming constructs such as: basic computation, simple I/O, standard conditional and iterative structures, methods, and parameter passing.		
Assessment	15% practical tests, 15% theory tests, 10% assignments (40% Continuous assessment) 60% final practical and theory examination		
DP Requirements	40% Continuous Assessment Mark, 80% Attendance at practical's		

Title	Engineering Drawing		
Code	**5MEC111**	**Department**	**Mechanical Engineering**
Prerequisites	**None**	**Co-requisites**	**None**
Aim	The aim of this module is to use conventional drawing techniques to develop the skill of reading, interpreting and creating engineering drawings using drawing instruments and free hand sketches		
Content	1. Understand the concepts of scales and proportions, lines in space and true length and shape. 2. Understand and apply the drawing standards for international graphic communication. 3. Competently use drawing instruments to generate: • orthographic detailed drawings • pictorial views with an emphasis on isometric views • sectioned and auxiliary views of engineering components 4. Generate free hand sketches of orthographic and pictorial projections of engineering components. 5. Communicate with a workshop / manufacturing environment by means of notes and dimensions on drawings. 6. Interpret the information on an orthographic detailed working drawing.		
Assessment	Test 1: Descriptive Geometry Test 20% Test 2: Descriptive Geometry Test 20% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's and fieldwork		

Title	Engineering Mechanics		
Code	**4MTH181**	**Department**	**Mathematical Sciences**
Prerequisites	**4MTH171(DP)**	**Co-requisites**	**None**
Aim	Engineering Mechanics is the first module that prepares students to analyze forces and stresses that exist in structures and machines. It is therefore an extremely important foundational module. The central core of the module has to do with equilibrium of rigid bodies and fixed structures such as trusses and beams. This module continues the modelling approach begun in Physics (for particles) and extends it to rigid bodies in static equilibrium. Although not a mathematics module, aspects of mathematics are brought to bear on the formulation and solution of equilibrium problems. The engineer requires skills of both analysis and of modelling. This module, being an introduction, will emphasize the analysis but will begin to develop the modelling ability in students. The module is concerned with developing ways of "seeing" or visualizing equilibrium problems. It is crucial to develop a variety of skills and strategies that will be used in solving problems, but it is also essential that students realize that these are necessary but not sufficient conditions for problem solving. The visual aspect of recognizing equilibrium, simplifying the system, drawing free body diagrams and applying appropriate boundary conditions is what is really important to develop in students. The importance of geometric ability cannot be over-emphasized. The module aims to develop in students an appreciation of forces in their various forms or guises, internal and external, and the way in which they contribute to the equilibrium of an object. The module requires a professional approach that recognizes the need for precision in engineering problem solving, mathematical language, a logical approach to calculations, diagrams that are accurate representations of the physical situation and a layout that is neat.		
Content	1. Review of vectors a. Position, displacement and force vectors b. Line of action and transmissibility, addition of forces at a point c. Adding forces: resultants, components, unit vectors 2. Forces a. Normal reaction and friction b. Equilibrium for a particle c. Connected particles d. Limiting equilibrium: friction, toppling, sliding e. Free body diagrams 3. Parallel and non-parallel coplanar forces, a. Moment of a force, couples, principle of moments b. Addition of a force and a couple c. Resultant and equilibrium for a rigid body, internal forces, toppling and sliding d. Two-force and three-force systems e. Compound systems f. Trusses: methods of nodes and sections g. Beams: bending moments and shear forces		
Assessment	40% Continuous Assessment Mark 60% Formal end of module exam (3 hours)		
DP Requirement	40% Continuous Assessment Mark 80% Attendance at lectures and tutorials		

Title	General Chemistry for Engineers		
Code	4CHM172	Department	Chemistry
Prerequisites	None	Co-requisites	None
Aim	The aim of this module is to give learners the necessary grounding in chemistry for further studies in analytical, inorganic, organic and physical chemistry		
Content	The nature of matter. Atomic structure and periodicity. Electron configurations and bonding. Types of chemical reactions. Chemical equations and the mole concept. The solid, liquid and gaseous states. Solutions. Thermochemistry. Chemical equilibrium. Chemical Kinetics. Redox equations and basic electrochemistry. Acids, bases and salts. Theory of acid-base titrations, including ph. Basic laboratory skills, including weighing and volume measurements and gravimetric, volumetric, and qualitative analyses		
Outcome	Learners must be able to demonstrate: ▪ an understanding of the structure of the atom, the chemical bonding which occurs between atoms and the types of chemical reactions that occur. ▪ an ability to write chemical formulas, balance equations, and apply the mole concepts in chemical calculations to mass reactions and reactions in solution. ▪ an understanding of the classification of matter and the fundamental properties of matter in the solid, liquid and gaseous phases and of solutions. ▪ a thorough grasp of the basic principles of thermochemistry, chemical equilibrium, chemical kinetics, basic electrochemistry and the characteristics of acids, bases and salts as well as the application of this knowledge to acid base titrations. ▪ an ability to perform a range of basic laboratory skills, including weighing and volume measurements and simple gravimetric, volumetric, and qualitative analyses		
Assessment	40% Continuous Assessment Mark (comprising 20% practical assessments plus 20% Interim assessments.) 60% Summative assessment(comprising a 3 hour assessment after the course work has been completed)		
DP Requirement	40% Continuous Assessment Mark 80% Attendance at practical's		

Title	Calculus II for Engineers		
Code	4MTH172	Department	Mathematical Sciences
Prerequisites	4MTH171(DP)	Co-requisites	None
Aim	The aim of the module is to further develop concepts in calculus (integration, elementary introduction to differential equations) and to apply their techniques in problem solving.		
Content	• Differentiation: some differentiation formulas, the chain rule, implicit differentiation, the mean-value theorem and applications, some curve sketching, applications of derivatives. • Integration and Techniques of integration: the fundamental theorem of integral calculus, indefinite integrals, some area problems, • Transcendental functions: logarithmic, exponential, inverse trigonometric functions, hyperbolic functions. • Elementary Introduction to Differential Equations: First order linear equations. • Sequences: properties, limits.		
Assessment	40% Continuous Assessment Mark 60% Formal end of module exam (3 hours)		
DP Requirement	40% Continuous Assessment Mark 80% Attendance at lectures and tutorials		

Title	Nuclear Physics, Electromagnetism and Modern Physics for Engineers		
Code	**4PHY172**	**Department**	**Physics and Engineering**
Prerequisites	**4PHY171(DP)**	**Co-requisites**	**None**
Aim	The module is meant for entry level B.Sc. and contains fundamental concepts in Physics and Engineering that prepares the student for later study in more advanced fields in the Physical Sciences. It contains basic concepts in electricity, nuclear physics and modern physics.		
Content	• Electricity and Magnetism: Coulomb's law, conductors and insulators. The electric field. Gauss' law. Potential, electrical potential energy, line integral of electric field, Capacitance, dielectrics and properties of dielectrics, Electric circuits. Magnetic field and magnetism, motion of charges particles through magnetic fields, the cyclotron. Ampere's law. Induced electromotive force, The R-L circuit and the L-C circuit. • Magnetic properties of matter, materials, permeability, molecular theory. Magnetization and susceptibility. Hysteresis. Magnetic field of the earth. Magnetic circuits. • Atomic Physics and radioactivity: Quantum theory of radiation. Wien and Stefan's laws. Planck's radiation formula. Radioactivity, natural decay series. Detectors of radiation, Nuclear reactions, conservation laws, reaction process, proton-induced, neutron-induced and other reactions. Q-values, alpha-. beta- and gamma-decay. Nuclear binding energy. Fission and fusion. Reactors, nuclear fuel, breeders. • Cosmic radiation and fundamental principles. • Practical: Laboratory sessions on precision calculations in experimental results, forces, mechanics, optics heat and properties of matter.		
Outcomes	▪ An understanding of statistical concepts for data analysis and presentation. ▪ An understanding of basic in static electricity, natural phenomena such as lightening, and the principles of machines based on static electricity concepts such as Van De Graaf Generators. ▪ An understanding of electric current and its effects (such as heating) ▪ The generation of electricity (Faraday's law, Lenz's law, etc.) ▪ A learner should understand the basic concepts of radioactivity, constituents of the nucleus and the effect of radiation. ▪ Learners should be able to solve problems related to theory taught. ▪ Learners should be able to identify most of laboratory instruments used in the level 1 laboratory and use these properly to obtain meaningful results ▪ Learners must be able to write simple scientific reports commensurate with level 1 B.Sc.		
Assessment	40% Continuous Assessment Mark 60% Formal end of module exam (3 hours)		
DP Requirement	40% Continuous Assessment Mark 80% Attendance at practical's and fieldwork		

Title	Introduction to Engineering Design		
Code	**5MEC112**	**Department**	**Mechanical Engineering**
Prerequisites	**5MEC111(DP)**	**Co-requisites**	**None**
Aim	Engineering graphics is the medium for communicating concepts and component manufacturing information. This module aims at developing the skills needed for documenting designs using drawings. Manual and computer aided methods of graphical communication will be used to introduce the fundamentals of descriptive geometry and apply the concepts of basic design for manufacturing.		
Content	1. Understand the concepts of scales and proportions, lines in space and true length and shape. 2. Understand and apply the drawing standards for international graphic communication. 3. Competently use drawing instruments to generate: • orthographic detailed drawings • pictorial views with an emphasis on isometric views • sectioned and auxiliary views of engineering components 4. Generate free hand sketches of orthographic and pictorial projections of engineering components. 5. Communicate with a workshop / manufacturing environment by means of notes and dimensions on drawings. 6. Interpret the information on an orthographic detailed working drawing. 7. Use 3D computer aided drawing software as a tool to • Generate working drawings for manufacturing with design intent. • Apply dimension standards to drawings. • Generate assembly drawings applicable to manufacturing. 8. Understand the fundamentals of Fits and Tolerances • Calculations and IT tables 9. Understand constraints and degrees of freedom in assembled mechanical components.		
Assessment	Tests 25% CAD assignments 15% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's and fieldwork		

Title	**Introduction to Engineering**		
Code	**5EEE112**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**4MTH171(DP)**	**Co-requisites**	**None**
Aim	• To motivate students and help them understand the nature and scope of engineering and specifically electrical engineering • To familiarize students to electrical circuits • Introduce electrical network theorems • To introduce the concept of DC response, steady state AC response and transient response of circuits • To analyze steady state single phase AC circuits using phasor diagrams		
Content	Explanation of the engineering disciplines and some job descriptions for each discipline. Circuit terminology, basic laws of resistive networks, nodal and mesh analysis, further network theorems, energy storage elements, RC and RL circuits, second order circuit analysis, RLC circuits and resonance, introduction to sinusoids and phasors, phasors in steady state AC circuit analysis, AC steady state power in single phase circuits. Introduction to transient analysis of circuits with energy storage elements.		
Assessment	Continuous assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Degree Module Content Second Year (Shared second year modules for Electrical Engineering + Mechanical Engineering)

Title	Advanced calculus for Engineers		
Code	**4MTH271**	**Department**	**Mathematical sciences**
Prerequisites	**4MTH171, 4MTH172**	**Co-requisites**	**None**
Aim	This module is designed to introduce students to the concepts of series, vector functions, differentiation and integration of vector functions and functions of several variables.		
Content	• Intro to infinite series: The integral test The comparison test, The root test & the ratio test • Absolute and conditional convergence • Taylors polynomial in x; taylors theorem in x • Taylors series in (x-a) • Vector equation for a line & Vector equation for a plane • Limits, continuity, differentiation of Vector functions • The evaluation of double integrals by repeated integrals • The double integral as the limit of a Reimann sum • Triple integrals & Reduction to repeated integrals • Cylindrical co-ordinates & Spherical co-ordinates • Jacobian		
Assessment	40% continuous assessment 60% formal end of semester 3hr exam on all material covered during the semester.		
DP Requirement	40% Continuous Assessment Mark 80% Attendance at lectures and tutorials		

Title	Signals and Systems I		
Code	**5EEE221**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**5EEE112**	**Co-requisites**	**None**
Aim	The module provides students with the basic tools required for understanding linear systems, and the effect that such systems have on deterministic signals.		
Content	• This module provides students with the tools required for understanding linear • systems, and the effect that such systems have on deterministic signals. • Upon completion, students will be able to characterize and manipulate linear time- • Invariant systems in terms of input-output relationships, using both time and frequency • domain methods. • The module includes concepts related to signal representation, linear convolution, • Fourier analysis, and sampling of continuous-time signals.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Analogue Electronic Design		
Code	**5EEE231**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**5EEE112**	**Co-requisites**	**None**
Aim	Students are introduced to device structures of some of the important Analog Electronic devices, their properties and models, analysis of simple circuits consisting of passive and active devices, operational amplifiers, and analysis of some practical analog electronic circuits.		
Content	• The module is delivered in the forms of lectures. There is a fixed text book for the • module, which standardizes the module. • After every 2- 3 weeks' lecture, the students are given a set of SPICE based simulation • exercises which helps them to grasp the material. The SPICE exercises are so • modelled that the students can see the importance of different device parameters and • their effect on some basic designs. • There are also four tutorials given in the module, and tutors are available on the tutorial • classes to help the struggling students. There is an end-of-semester mini project done • in groups. With this, the students try to design and analyze a bigger circuit and make a • report. This helps them to grasp some of the challenges of designing an electronic circuits.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Linear Algebra and Differential Equations for Engineers		
Code	**4MTH272**	**Department**	**Mathematical sciences**
Prerequisites	**4MTH171, 4MTH172**	**Co-requisites**	**None**
Aim	This module is designed to introduce students to the concepts of linear algebra, and to methods of finding exact solutions to ordinary differential equations		
Content	• Linear algebra: finite and infinite dimensional vector spaces, subspaces, linear transformations and matrices, systems of linear equations, determinants, change of bases, similar matrices, eigenvalues and eigenvectors. • Differential equations: study ordinary differential equations such as separable variables, exact equations, linear equations. Solutions of homogeneous differential equations with constant coefficients, Cauchy-Euler equation, systems of linear equations, nonlinear equations, Laplace transforms, homogeneous linear systems with constant coefficients.		
Assessment	40% continuous assessment (two assessments during the semester each carrying a weight of 20%) 60% formal end of semester 3hr exam on all material covered during the semester.		
DP Requirement	40% Continuous Assessment Mark 80% Attendance at lectures and tutorials		

Title	Introduction to Power Engineering		
Code	**5EEE212**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**5EEE112**	**Co-requisites**	**None**
Aim	To provide a foundation in power engineering		
Content	Phasor diagrams for resistive, inductive and capacitive loads; transient analysis of circuits, complex power; power factor correction; 3-phase systems; magnetic circuits; the single phase transformer; dc. machines		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Degree Module Content Specific to Second Year Electrical Engineering only

Title	Embedded Systems I		
Code	**5EEE211**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**5EEE112**	**Co-requisites**	**None**
Aim	This module aims to give students a strong foundation in embedded systems by introducing them to digital system fundamentals, including information representation, Boolean algebra, logic gate behavior, combinational and sequential digital circuits, digital building blocks and algorithmic state machines. The module also provides a basic understanding of what a microcontroller is, how it works inside and what it can be used for. These objectives will be carried out by writing code for a micro in ASM and C		
Content	• The goal in convening this module is to impart elementary knowledge and a basic • understanding of logic and computer design and the advances in the underlying • technology that have had an impact on the application of these fundamentals. • We also aim to enable the student to design a prescribed digital system and finite state • machine. At the end of the study, the student must be able to appreciate the role of • digital electronics in computer and automation systems. The topic sequence to bring • this about consists mainly of the following: • Digital systems and information representation, Binary logic, Boolean Algebra, • combinational circuits, combinational design concepts and procedures, arithmetic • functions, sequential circuits, combinational design concepts and procedures. Digital • storage and representation of data in a memory architecture. • The purpose and capabilities of a simple ARM CPU. Instruction sets, op codes and • operands. Compiling, assembling, linking and loading of code using a command line • tool chain. Debugging code in execution. Assembly conditional statements, loops and • interrupts. Peripherals: GPIO, ADC, Timers, SPI. These concepts will then be • re-iterated using the C language. An IDE will be used. Functions, pointers, function • pointers, while, for, if, logic operations.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Professional Communications		
Code	5EEE241	Department	Electrical, Electronic and Computer Engineering
Prerequisites	All first year modules	Co-requisites	None
Aim	The aim of the module is to equip students with theory of oral and written communication, and to give them practical skills that will enable them to communicate more effectively at the University and in their professional careers.		
Content	Referential Style and Academic writing and presentation; Planning & Discourse of technical written and oral messages; Reports – investigative/ evaluative; Executive Summaries/ Synopses; Individual presentations; graphics and visual literacy. Module content covers the following areas: Communication theory: • aim of communication • barriers to communication • audience and readership analysis • modes of communication Planning and Discourse: • definitions and schools • reasons for codes and rules • professional practice as defined by ECSA • corporate governance and King III report Reports: • types: investigative and feasibility • research: citation and referencing • different formats for types of reports • sections within reports (introduction, methods, results, conclusions, recommendations) and their functions • preliminary sections such as Table of Contents • final sections such as Appendices Summaries: • purpose of an executive summary to a technical or professional report		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Electromagnetism for Engineers		
Code	4PHY272	Department	Physics and Engineering
Prerequisites	4PHY171, 4PHY172	Co-requisites	None
Aim	This module is designed to introduce students to the concepts of and theories applicable to electromagnetism and its applications		
Content	• electromagnetism • Electrostatics, Gauss's law. Dipoles. Dielectric media. Phenomena related to electron levels: Introduction to metals, semi-conductors and insulators. Contact potential. Thermoelectric effects. • Electromagnetism: Forces on moving charges in electric and magnetic fields. Magnetic scalar potential and vector potential. Ampere's law. Faraday's law. Self-induction and mutual induction. • Alternating current: M L C R circuits and A-C bridges • Magnetism: dia, para-and ferromagnetic materials. The magnetic circuit. • Applications of concepts and theories of electromagnetism • Transmission lines, microwaves, waveguides, electromagnetic interference.		
Outcomes	▪ An understanding of concepts and theories of electromagnetism. ▪ Understanding and applications of Gauss law. ▪ An understanding of laws governing electrical conduction and circuits. ▪ Understanding principles of magnetism and magnetic circuits ▪ Understanding applications of electromagnetism.		
Assessment	40% Continuous Assessment Mark (10% practical assessments; 25% Interim test; 5% Assignments) 60% Formal end of module exam (3 hours)		
DP Requirement	40% Continuous Assessment Mark 80% Attendance at practical's and fieldwork		

Title	Introduction to Programming for Engineers		
Code	4CPS172	Department	Computer Science
Prerequisites	4CPS171	Co-requisites	None
Aim	To equip students with foundational programming skills including basic data structures.		
Content	Foundational Concepts; Overview of Structured Programming; Procedure-based versus Object-based thinking; Introductory UML representation of Object concepts; Object-oriented programming; Basic Concepts: objects, strings, arrays, classes, GUI, User-defined classes, and ADTs. Inheritance and Polymorphism, Implementation of object-oriented programming concepts using Java.		
Outcomes	• Demonstrate the ability to use Java constructs to build Objects and object relationships and interactions; • Usage of UML language to represent core Object-oriented concepts such as encapsulation, inheritance and polymorphism; • Acquire skills to use basic data structure algorithms covering array, list, stack and composite data structures based on them.		
Assessment	Continuous Assessment 40% (consists of 20% Test, 12% Practical and 8% Assignment) Examination 60%		
DP Requirement	40% minimum must be scored by a student to qualify to write examination.		

Title	Project Management		
Code	5MEC242	Department	Mechanical Engineering
Prerequisites	All first year modules	Co-requisites	None
Aim	This module deals with the theory, tools, techniques and practices in project management. Opportunities are provided to develop an understanding of the triangle of Project Management (PM) – time, cost and performance and to use PM techniques to achieve objectives within triangle constrains. The application of the theory, tools, techniques and practices is an objective. This takes the form of a multidisciplinary project i.e. development of a small scale engineering system.		
Content	• Introduction to Project Management Introduction to Project Planning and Life Cycle Project Scope Management • Project Time Planning and Network Costing Project and Financial Statement Managing Project Resources • Managing Risk in Projects • Project Quality Management Project Human Resource Project Contracts • Trade-off Analysis in a Project Environment Project Closeout • Tools include, but are not limited to, WBS, CPM, Gantt Chart, Resource Levelling, Cash Flow Statement, Trade- off analysis and communication techniques		
Assessment	Continuous Assessment 40% Examination 60%		

Degree Module Content Specific to Second Year Mechanical Engineering Only

Title	**Mechanics of Solids I**		
Code	**5MEC211**	**Department**	**Mechanical Engineering**
Prerequisites	**4MTH172, 4MTH182**	**Co-requisites**	**None**
Aim	A student who successfully completes this Module will have a thorough grounding in the essential principles of Mechanics of Solids. He or she will also have the understanding and capability to formulate and undertake problem solving in the areas of (i) simple direct stress and strain, (ii) shearing force and bending moment, (iii) bending stress, (iv) deflection, (v) torsion, and (vi) analysis of complex stress and strain (in 2 dimensions). In addition, they would be aware of the limitations of the mathematical modelling, (e.g. St Venant's principle, "point" loads, stress concentrations, symmetric sections, isotropic materials) as well as the value of free body diagrams, and the range of applicability of the formulations (eg. Only 2 dimensions, statically determinant structures, axi-symmetric sections for torsion).		
Content	Simple Stress and strain: • Understanding of material tensile stress behaviour, Young's modulus and Poisson's ration. • Formulation of solving of direct stress problems, including pre-stress and temperature induced loads. Shearing of force and bending moment: • Determination of reactions and subsequently drawing up free body diagrams for loaded structures. • Accurate drawing up of shear force and bending moment diagrams on the exploded structure. Bending Stress. • Clear understanding of the relationship between moment M, second moment of area I, stress δ, distance to outer fibre y, Young's modulus E and radius of curvature R. • Calculation of second moment of areas for symmetrical and non-symmetrical sections as well as compound beams. Determination of stress under various loads. Defection of beams: • Calculation of beam deflection using direct integration, Macaulay's method and moment area techniques. Torsion: • Strong understanding of the relationship between Torque T, polar moments of J, shear stress τ, radius R, shear modulus G, and angular twist θ/L, for round sections. Calculation of polar moments of area, and determination of torsional stresses and general torsional behaviour, including power transmission. Analysis of complex stress and strain: • Understanding of shear stress and strain in two dimensions. Calculation of stresses on an inclined plane. Determination of principal stresses and planes and use of Mohr's circle.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Materials Science in Engineering		
Code	5MEC221	Department	Mechanical Engineering
Prerequisites	4MTH172, 4MTH182	Co-requisites	None
Aim	Any design engineer should know how to select materials which best fit the demands of a particular design – economic and aesthetic demands, as well as demands of strength and durability. This Module is intended to give a broad introduction to these properties and limitations. It cannot make you a materials expert, but it can teach you how to make a sensible choice of material, how to avoid mistakes that have led to embarrassment or tragedy in the past, and where to turn to for further, more detailed assistance.		
Content	Overview of the classification, price and availability of engineering materials. • Structure-property relationships of metallic materials, with particular emphasis on the transition from elastic to plastic behaviour. • Description and measurement of mechanical properties of metals. • Modification of the properties of metals by deformation and heat treatment (consider plain carbon steels and low alloy steels as examples). • Structure-property relationships of ceramic and amorphous (glass) materials, with particular emphasis on brittle behaviour and crack growth. • Measurement of fracture toughness in relation to the energy required to propagate a crack. • Modification of the properties of ceramics and glasses by controlled processing (eg thermal treatment to induce residual stress) and composite design (eg influence of fibres on crack propagation). • Structure-property relationships of polymeric materials, with particular emphasis on the classification of thermoplastics, thermosets and elastomers. • Description of the manufacture of polymer components using processes such as extrusion, spinning, and injection and blow moulding. • The principles of reinforcement and design on the properties of composite materials. • Relationship between structure and the electrical behaviour of engineering materials. • Influence of environmental effects (particularly corrosion) on the deterioration and degradation of materials. The Cambridge Engineering Selector (CES): • The first steps in optimising the selection of materials in design (translation, screening, documentation). • Ranking materials suitability using material indices. • Several case studies in materials selection.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Thermofluids I		
Code	**4MEC212**	**Department**	**Mechanical Engineering**
Prerequisites	**4MTH172, 4MTH182**	**Co-requisites**	**None**
Aim	The aim of this Module is to introduce students to the thermodynamics and fluid mechanics sciences. In particular, students will gain an understanding of the 1st law of thermodynamics, mechanisms of heat transfer, as well as hydrostatic forces, pressure and momentum associated with fluid flow.		
Content	The subject will be covered by presenting both the theory as well as solving examples related to the individual topics. The Module will cover principles and examples of: ▪ The fundamentals of pressure, temperature and forms of energy. ▪ The origin and calculation of hydrostatic forces and pressure and their application. ▪ The First Law of Thermodynamics and its application to closed systems and control volumes. ▪ Property Tables and Equations of State. ▪ Equations of continuity and momentum and their applications.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Dynamics I		
Code	**5MEC232**	**Department**	**Mechanical Engineering**
Prerequisites	**4MTH172, 4MTH182**	**Co-requisites**	**None**
Aim	The objective of this Module is to review and extend the fundamental principles and formulations of the kinematics and kinetics of Newtonian mechanics in the context of problems involving the dynamics of particles and rigid bodies.		
Content	Particle Kinematics: Rectilinear, plane and curvilinear motion Relative and constrained motion Particle Kinetics: Newton's 2nd law Work, kinetic energy and potential energy (power and efficiency) Linear and angular impulse-momentum and impact D'Alembert's principle Rigid Body Kinematics: Rotation and absolute motion Instantaneous centres of zero velocity Relative velocity and acceleration Motion relative to rotating axes (Coriolis acceleration)		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Mechanical Engineering Machine Element Design I		
Code	**5MEC232**	**Department**	**Mechanical Engineering**
Prerequisites	**5MEC112, 5MEC122**	**Co-requisites**	**None**
Aim	The aim of this module is to introduce students to the design process for Mechanical Engineering Machine elements.		
Content	This Module introduces the basic engineering design process, applied to selection of simple machine components and development of basic machine assemblies. It draws on basic engineering science (Solid Mechanics, Materials Science, Dynamics) and applied engineering topics (Manufacturing Processes) to understand how machine components are selected and sized, depending on the required application and function. Computer Aided Modelling and Design (CAD) principles, which are introduced in first year, are developed further in the modelling and analysis of more realistic and complex machine assemblies. Topics to be covered during the Module will include: Elementary Design Process; manufacturing processes; tolerances of size and geometry; bearing type selection and sizing; gear type selection and kinematics; flexible drive selection and kinetics; fasteners and sealing; and design for static strength and stiffness.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Degree Module Content for 3rd year and 4th year Electrical Engineering

Title	Electromagnetic Engineering		
Code	**5EEE311**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**4PHY272,4MTH271**	**Co-requisites**	**None**
Aim	To provide an understanding of electromagnetic field and wave theory in the context of applications in electrical engineering. To convey the relationship between electromagnetic field theory described by Maxwell's equations and circuit theory described by Kirchhoff's laws. To cover the concepts of EM wave radiation, propagation, reflection and refraction in linear media. To introduce radiation from simple structures, and basic calculations of EM field parameters at a distance from a radiating antenna, and calculations relating to line-of-sight communications link. To provide the theory required for more specialized EM topics like microwave engineering and antenna design. Visualization of electromagnetic fields.		
Content	The module introduces the electrical engineering student to the mechanism of electromagnetic radiation by antennas and the nature of fields produced by antennas. The propagation of plane waves in space and in lossy media is studied and applications are presented. One-dimensional models for TEM transmission lines are constructed. These models are often used as basic elements in design of antennas and other components. Simplification to very short lines such as power lines are discussed. A selection of conventional and modern waveguide structures re considered. Finally, an overview of computational methods for the solution of realistic electromagnetic problems are presented.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Electronic Devices and Circuits		
Code	**5EEE321**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**5EEE231**	**Co-requisites**	**None**
Aim	To provide the student with an understanding of basic electronics concepts and also to equip the student with the necessary skills to perform detailed electronics design and analysis		
Content	Operational amplifiers, specifications and limitations and varieties and common configurations. Frequency response of amplifiers; Bodes plot Basic building blocks of analog ICs and circuits; current mirrors. Feedback and its effects in analog circuit design; stability Analog filters: filter design principles; different common ways to implement filters. Signal generators: oscillators and types of oscillators. Power Amplifiers Noise, sources and types. Switched mode power supplies and introduction to power electronics, buck, boost, buck-boost and isolated fly back topologies Safe Operating Area, mixed signal design, circuit layout, decoupling and grounding SPICE based simulations		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Energy Conversion		
Code	**5EEE331**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**5EEE212**	**Co-requisites**	**None**
Aim	To introduce students to the fundamentals of AC Electrical Machines and Power Electronics. Two machine types are studied, i.e. induction and synchronous machines. The constructional features, operational differences, capability and characteristics of each machine type are studied. Uncontrolled rectifier circuits and DC-DC converters are also being introduced. Industrial applications of power electronics and electrical machines are analyzed.		
Content	AC machine windings, rotating magnetic field in AC machines, induction and synchronous machine equivalent circuits, determination of equivalent circuit parameters, induction and synchronous machine performance characteristics, uncontrolled rectification, controlled rectification, dc-dc converters		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Signals and Systems II		
Code	5EEE341	Department	Electrical, Electronic and Computer Engineering
Prerequisites	5EEE221	Co-requisites	None
Aim	• To develop skills for the analysis of signals and noise in linear systems, and also some • non-linear systems • To convey how systems arising in electrical and electronic engineering may be analyzed in the time domain and the frequency domain. • To develop concepts such as bandwidth, response time, power spectral density, and signal to noise ratio for quantifying signals and noise in linear systems • To gain familiarity with basic modulation schemes used in communication systems and • instrumentation.		
Content	**Part A:** Random signals and processes in continuous /discrete time, probability distribution/density functions, random signals calculus (mean, variance, moment generation function), transforms of random signals, Bayesian Theorem, covariance and correlation, Central Limit theorem, Gaussian processes, random signals spectrum and bandwidth, power spectral density (PSD), Wiener-Khinchine Theorem, entropy function, estimation/filtering of random signals. **Part B:** Time and frequency domain signal processing for electronic systems (carrier-wave radio and instrumentation), continuous-time Fourier theory, sampled signals and use of the discrete Fourier transform, propagation of signals and noise through linear systems, complex analytic signal representation, power calculations using PSD functions, pulse detection using correlation and the matched filter, analog carrier-wave modulation/demodulation, amplitude modulation (double sideband and single sideband; suppressed carrier and large carrier), heterodyning, angle modulation (frequency and phase modulation), signal to- noise ratio calculations.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Statistics for Engineers		
Code	4STT171	Department	Mathematical Sciences
Prerequisites	4MTH171, 4MTH172	Co-requisites	None
Aim	This Module aims to introduce engineering students to the basic concepts and tools of Statistics which are of particular relevance in an engineering context, and to enable students to apply these to data collected from engineering experiments.		
Content	Topics include: Random variables, sampling and basic statistical measures; Normal, t, F and Chi-square distributions; Confidence intervals; Statistical models, such as the means and the effects models; t, F and Chi-square tests; Regression and correlation; One-way analysis of variance; Introduction to the design of experiments; Application of statistical tools to experimental data in an engineering setting.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Control Engineering		
Code	**5EEE312**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**4MTH271, 4MTH272, 5EEE231**	**Co-requisites**	**None**
Aim	To train and educate students in control engineering methods for SISO control problems, including formulation of elementary problems as block diagrams, analysis of system interconnected systems, design and synthesis of feedback control systems in terms of input-output and state-space models. To introduce students to open-ended control engineering projects by means of a team project centered around a control problem.		
Content	Terminology: Open and closed loop configurations, block diagrams, dynamic system modelling, transient response, stead state error criterion. System stability: Routh Hurwitz criterion, Root Locus. Frequency responses. Nyquist lots, Bode diagrams, Nichols Charts. Compensation: Lead-lag circuits, minor loops, feedforward and three-term controllers. Sensitivity functions, minimum prototype response controllers, bilinear transformation, frequency response methods. State variables, state space models and design methods. Robustness, observability controllability, stability and performance.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Power Systems		
Code	**5EEE322**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**5EEE212**	**Co-requisites**	**None**
Aim	To create an interest in power systems engineering, to provide a sound basis of study for those who will continue studies in this subject and, for those who do not continue with power modules, to provide useful information relevant to future needs		
Content	Structure of power system, ac power theory, electrical loads, customer tariffs and power factor correction, introduction to power systems analysis, including: 3-ph transformer representation, Per unit calculations, Load flow and fault calculations; AC and DC power distributors, Transmission efficiency and conductor efficacy; Protection principles and Matlab programming.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Communications and Networks		
Code	5EEE332	Department	Electrical, Electronic and Computer Engineering
Prerequisites	5EEE231	Co-requisites	None
Aim	To provide a basic understanding of communication systems and the architecture, technology, and protocols of computer networks		
Content	**Module A:** Introduction to Networks: Internet, protocol, network edge, core network and access networks, circuit switching and packet switching, LAN topology, physical media, layered architecture, performance, protocol model. Application layer: service, client-server paradigm, network applications: web and http, ftp, email, ssh, DNS, p2p file sharing, socket programming. Transport layer: transport layer services, multiplexing/demultiplexing, Network layer: Introduction, virtual circuit and datagram networks, router, Internet Protocol datagram, fragmentation, IPv4, Physical layer: Digital information, Digital communication system, Sampling, Pulse modulation, Quantization, Pulse code modulation, Bandpass modulation schemes ASK, FSK, PSK, Phase-shift keying and amplitude phase keying in vector representation, Orthogon **Module B:** Communication system and network design II : Transport layer: UDP, reliable data transfer, TCP, connection management, congestion and congestion control. Network layer: ICPM, IPv6, link-state algorithm, distance vector routing algorithm, routing in Internet, broadcast and multicast routing. Data link layer: link layer services, error detection and correction. Multiple access: TDMA, Aloha, CSMA. LAN technologies: IEEE 802 family, MAC, LAN addressing, ARP, Ethernet, Token Rings, hubs and switches, PPP, ATM, MPLS, all IP networks. Physical layer: Information theory and entropy, Channel capacity, Source coding, Probability of error, Eb/n performance, Matched filter detection, ISI and pulse shaping, Equalization, Bandpass demodulation/detection schemes with ASK, FSK, PSK, Probability of Error with bandpass detection, MSK		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Culture and Society in Africa		
Code	1ANT172	Department	Social Anthropology
Prerequisites	None	Co-requisites	None
Aim	This is a Complementary Studies Module for Electrical Engineering students aimed at broadening student's perspective.		
Content	Culture and Society in Africa provides students from all faculties with background knowledge about the continent on which they live. The module includes an examination of the concepts of culture, race, society, ethnicity and nation-state, a perspective on African worldviews and ways of thought, and a consideration of the role of Africa in a changing world.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Electrical Engineering Design and Research Methods		
Code	**5EEE342**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**All second year modules**	**Co-requisites**	**None**
Aim	To tackle a design and research project in Electrical Engineering		
Content	In this module students will be assigned a design problem relevant to the Electrical Engineering discipline within which they will need to design a prototype and test a sub-system. This will provide insight to understand the intricacies of real-life complex sub system design. Students will be expected to solve an Electrical Engineering problem methodically using the skills they have gathered over the previous semesters of the curriculum, especially from the Design 1 module. Financial constraints required to complete the project and financial decision making will be reported.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Process Control and Instrumentation		
Code	**5EEE411**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**5EEE312**	**Co-requisites**	**None**
Aim	Aims to provide an integrated view of the principles and practice of modern industrial control and its applications		
Content	Various topics will be covered including: Measurement of physical variables, industrial transducers, integration of programmable logic controllers (PLCS), supervisory control and data acquisition (SCADA) systems and management information systems (MIS), signal transmission and conditioning, microcontrollers, computer interfacing, realtime multitasking in computer control, nonlinear and advanced control methods.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Engineering Systems Design		
Code	**5EEE421**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**5EEE342**	**Co-requisites**	**None**
Aim	To understand and apply the principles of engineering design		
Content	**Design environment** - Project, production and manufacturing processes. The pessimistic mind view - worst-case design, tolerances, reliability and statistical yield. Standards and codes. STEEP analysis - social, technical, environmental, economic and political context. EDA and CAD *Design methods* - Synthesis of candidate concepts and selection of an optimum concept; development of specifications and user requirements; modelling, simulation, reality checks; design work; qualification and acceptance tests; documentation. Case histories **Formal Design Methodology** - Common features of formal design methodologies. IBM's Rational Unified Process. Phases and iterations -inception, elaboration, construction, transition. **Disciplines** - business modelling, requirements gathering, analysis and design, implementation, testing, deployment, project management, configuration and change management, environment. **Project** – Two assignments will be tackled, and a poster will be prepared and presented.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Engineering Professionalism		
Code	**5MEC451**	**Department**	**Mechanical Engineering**
Prerequisites	**All 3rd year modules**	**Co-requisites**	**None**
Aim	This module deals practically with the student's transition to the workplace. The aim is to complement the student's theoretical training by introducing (in some cases) and reinforcing (in others) the topics and issues most likely to be encountered in the engineering profession. This is part of the endeavour to produce a well-rounded mechanical engineer for industry, consulting and the design environment		
Content	Professional registration – ECSA, the Washington Accord, code of conduct, due diligence, government certificate of competence, mentorship in industry. Types of engineering employment – details of the options available for graduates, the realities of the workplace and industry training, career path management. Engineering economics – working capital, cash flow, salaries and wages, depreciation, tax considerations, rate of return, payback period. Health and Safety – managing disease and health in the workplace, occupational safety and related legislation, practical HAZOP analysis, safe work permits and lockouts. Industrial law – Overview of employment law, labour relations and employment equity contracts, basis of offer and acceptance. Quality, reliability and maintenance management and their importance in the engineering profession. Environment – legislation, ISO140001, aspects of engineering operations and likely impacts, considerations of the created environment as well as the impacts on socio-economic and cultural systems.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Power Electronics and Machines		
Code	**5EEE431**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**5EEE331**	**Co-requisites**	**None**
Aim	To develop an understanding of electric motor speed control principles and to develop an understanding of power electronics and its practical applications		
Content	Electrical Machines: Introduction to Motor Drives, DC Motor Characteristics and Speed Control Principles, Class-A Chopper Drive, Induction Motor Drives, Unbalanced Operation of Induction Motors, Switch Reluctance Motors Power Electronics: Switching and Conduction Losses of Power Semiconductor Devices, Uncontrolled and Controlled rectifiers, Dc to Dc Converters: Buck, Boost, Chuck, Flyback and Full Bridge, Unipolar and Bipolar Pulse with Modulation Schemes, Space-Vector Pulse Width Modulation		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Power Systems Engineering		
Code	5EEE441	Department	Electrical, Electronic and Computer Engineering
Prerequisites	5EEE322	Co-requisites	None
Aim	To develop an understanding of power systems and protection		
Content	Distribution and transmission systems, protection systems, steady state operation of transmission lines, high voltage engineering, electricity pricing, microgrids and smart grids. Topics include: Loads - Electrical load characteristics (PIR, transient, statistical distribution and probabilistic load model), Non Linear Loads, non- active power, unbalance, Load data collection, Data analysis, Time series, parametric, sectoral and spatial load forecasting High Voltage Engineering - Introduction and fields, Gas discharges, solids, liquids; Over voltages, insulation coordination Branches – Cables, LV feeders voltage drop calculations, Herman Beta spread sheet, Overhead lines: design, safety, electric machinery regulations,3-ph overhead lines: types of structures and conductors, conductor selection, load capacity, line parameters; 3- ph overhead lines: cost, MV voltage drop and losses – radial feeder with point loads, minimum route length; Mechanical design of overhead lines, 2-ph and SWER lines: capacity, design, safety/reliability, unbalance; Comparison of alternative overhead lines, HVDC transmission.; Nodes - Small substations; Large substations; Unconventional: CCS, Captap, SWS; DG: Energy resources, environment and cost,: Voltage rise constraints Protection - Protection philosophy, switchgear and surge arresters, instrument transformers, , OC and DOC relays, Relay settings grading, Protection testing and commissioning, protection lab, , Unit feeder protection(circulating current ,pilot wire), Distance protection, Transformer protection delivery processes and policy - Delivery processes: planning design, construction, O&M (incl condition monitoring), EIA, QA,standards; Logframe for planning and evaluation of electrification; Electrification in SA, NEP, future electrification, EDI restructuring, Power Quality/Quality of Supply; Reliability; Financial evaluation of projects (IRR, NPV, inflation, losses, economics of pf correction); Pricing policy, rationalization, residential tariffs, BEST/		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Telecommunications		
Code	**5EEE451**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**5EEE332**	**Co-requisites**	**None**
Aim	To enhance an understanding of and competence in analyzing and designing wireless communication systems to specified performance criteria. To extend your study of principles of communication engineering towards current design topics.		
Content	Selected topics in (1) digital communication systems (24 lectures) and (2) radio frequency & wireless systems (24 lectures). Digital Communication Systems Content: Any topics from: *Digital Modulation*: highlights; *Formatting and Source Coding*; *Synchronization*; *Reducing Signal Degradation*: signals, spectra and noise, communications link analysis, coding and interleaving to mitigate fading effects, main parameters of *Fading Channel Models*, applications. *Modulation and Coding* trade-offs; *Error Performance* of communication systems corrupted by noise. [Fundamental Digital Communication Systems Concepts: *Communication theory* enables us to understand how to insert, protect, transmit and extract information by applying successive transformations and forcing functions to enable signals to propagate through a number of stages (modules) from the source to the destination. *Digital formatting and modulation* in wireless systems are transformation techniques for encoding information into some digital format at low frequencies, mapping the coded sequence onto a high frequency and high energy sinusoid for transfer through the air or free space and then reversing the process at the receiving destination [insertion, protection, transmission and extraction]. *Random process theory* enables us to use probabilistic and Fourier models in time, space and frequency to describe and estimate signals when their characteristics at an instant are not fully accessible for measurement. We apply random process theory to real voice, data, video, noise and interference signals. *Linear systems theory along with information theory and Fourier techniques* provide a modelling framework for describing, analyzing and testing signals and circuits used in transferring information from selected sources to intended destinations. Through that framework, we can determine things like: the maximum density of distinct signals we can pack into a single channel of finite bandwidth, creating logical channels out of physical versions, how we can insert a driving function at some point in the system and measure a delayed effect (convolution, impulse response, transfer function) elsewhere across the system by assuming distortionless transmission of amplitude, frequency and phase information, modelling a channel as a filter for shaping and controlling the bandwidths of signals in it, and analyzing the frequency components of a received information signal. *How do we know when we are doing well or badly in this field of work?* An analysis of *spectral efficiency* reveals how many bits per second per Hertz of bandwidth we can push through a channel using a given approach to modulate and allocate resources for the available bandwidth. On the other hand, an analysis of the minimum amount of energy required to reduce the rate of occurrence of errors in a given transmission to a desired level reveals the *energy efficiency* of a given coding/modulation/multiple-access (i.e., resource allocation) plan and implementation.] RF & Wireless Systems Content: Any topics from: Microwave and RF components and transmission lines; Mobile communication systems; Radar systems; Noise and distortion in microwave systems; Frequency planning; Regulatory aspects of Spectrum usage; Antenna technology; Satellite communication systems; Global Positioning Systems (GPS); Use of microwave test equipment.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Professional Communication Studies		
Code	**5EEE412**	**Department**	**Electrical, Electronic and Computer Engineering**
Prerequisites	**5EEE241**	**Co-requisites**	**None**
Aim	Professional Writing including: Business Proposals; Graphic Communication and Readability; Posters; Group presentations with Power-point		
Content	Referential and Academic writing and presentation; Persuasive argument; Formats for business plans and proposals; group presentations; graphics and visual literacy. Module content covers the following areas: Group theory and Team work: • aim of communication • barriers to communication • why groups are formed • types of groups • group dynamics and how teams are formed • advantages of groups. • different types of leaders • process and benefits of Brainstorming • different approaches to Problem-solving and decision-making. • negotiation skills Ethics: • definitions and schools • reasons for codes and rules • professional practice as defined by ECSA • corporate governance and King III report Business Plans and Proposals: • solicited and unsolicited proposals • requests for proposals • functions of SWOT and PESTEL • Table of Contents of a Business Proposal Summaries: • purpose of an executive summary • structure and components of a good executive summary • style and language for a persuasive and comprehensive summary CVs and Covering letters • formats for and choice and ordering of content • traditional and non-traditional CVs • covering letters for responding to an advertisement or tender and for direct approach. Poster Design: • difference between stand-alone posters and accompanied posters • fundamental principles of well-designed posters. Group presentations: • criteria for giving an effective group oral presentation • vocal delivery • techniques for good cohesion, transitioning and handover to the next person in the group • types of visual aids that support and enhance a good presentation • visual literacy and creating PowerPoint slides.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	New Venture Planning and Management		
Code	5EEE422	Department	Electrical, Electronic and Computer Engineering
Prerequisites	All third year modules	Co-requisites	None
Aim	Learning Business skills involved in starting entrepreneurial businesses from products designed: feasibility analysis, business plan, presentations		
Content	The entrepreneurial perspective; developing a new venture; what is a feasibility plan? Product concept and description; market assessment; industrial analysis; marketing plan; operations, development plans and management; financial projections		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Industrial Ecology		
Code	5MEC410	Department	Mechanical Engineering
Prerequisites	All third year Modules	Co-requisites	None
Aim	The module is an introduction and overview of the relatively new 'field' of Industrial Ecology and its more recent trends. In the context of the module "industrial ecology" is interpreted as encompassing all of the interactions of an industrial society with the natural environment as well as the associated drivers of industrialization. A more appropriate way of thinking about the module is to rename it "the Ecology of Industrial Society". The objectives are to encourage a systems perspective of industrial activity as it is integrated with and forms part of the natural systems (lithosphere, pedosphere, biosphere, hydrosphere, atmosphere) This module is intended to be an enjoyable and enlightening experience, given the very different kind of learning that is expected. The students in the class have the responsibility to make the learning their own – to engage in debate and ask questions that will lead to the class finding out new information and reading different literature than that originally proposed – because it concerns what interests you and what you want to learn. What you learn and the effects of industry on the environment both affect your future. We are all in this together – the learning and the living. Let's do it with enthusiasm and meaning. There are however, two primary educational goals for the module. The first has to do with the content and the second with the process. Students are expected to become aware of the problem issues facing the global community that relate to the industrial impact on the environment – the ecology of industrial society. You are expected to demonstrate this awareness and the acquisition of knowledge and understanding through discussion in class, through oral arguments, quizzes, projects, an exam and a term paper. These forms of communication hint at the second set of outcomes that relate to the ability to accomplish a limited kind of research as well as communicating ideas in a professional manner. Students are expected to put into practice the skills they have acquired in their professional communication module as well as using the opportunity to improve those skills. These do not only relate to the presentation side of the skills but also to the exploratory and critical aspects – being able to ask critical questions, seek information from the internet and other sources, argue a case in discussion as well as in a formal written presentation, show logical development of a debate and a willingness to be persuaded by a counter argument.		
Content	Ecosystem deterioration, pollution Resource depletion: Fossil fuels, water, uranium, rare earth metals Climate change Systems thinking, thermodynamics Sustainability; the limits to growth Industrial Ecology concepts and tools Material Flow Analysis Life Cycle Assessment; the circular economy Design for Environment Eco-Industrial Parks: industrial symbiosis Ethics: economic paradigms, consumption Energy, Mobility,		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Maritime Law for Engineers		
Code	2LMA472	Department	Law
Prerequisites	All third year Modules	Co-requisites	None
Aim	To empower students to understand, analyse, research, discuss, explain, evaluate, give advice concerning, and generally deal with Maritime Law - and internet related legal and policy issues.		
Content	Maritime law remains in many ways a truly international field of law. The United Nations, the International Maritime Organization, and other international bodies like the Comitè Maritime International have been instrumental in bringing into force a number of international conventions in the field of shipping, carriage of goods by sea, safety of life at sea, and the marine environment. The focus of this Module will be on those Conventions which have been ratified or adopted by South Africa as part of our domestic law. One sometimes hears the distinction made amongst maritime lawyers between "wet" and "dry" shipping work. "Wet work" relates primarily to incidents of navigation – that is problems that occur with ships at sea- such as collisions, unseaworthiness, salvage, towage, and oil spills. Dry work refers to the carriage of goods by sea and involves a study of the contracts involved and litigation of the claims that arise from the loss or damage to the cargo carried on board. In this area of maritime law the student must understand the inter-relationship between the contracts of carriage, the international sale contract, the marine insurance contract, and international finance. Thus maritime law intersects and overlaps other areas of study such as international trade, insurance, sale, tax and banking. Students will only be taught some of the basic concepts in this module, but will also be given a helpful overview of "the bigger picture".		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Final Year Research Project		
Code	5EEE432	Department	Electrical, Electronic and Computer Engineering
Prerequisites	Depends on the topic	Co-requisites	None
Aim	To give individual students the opportunity to tackle a real engineering project within a limited period under the guidance of a supervisor and submit a project report on the results.		
Content	The final year research project is an important opportunity for the student, at the end of the degree programme, to tackle a real engineering project. The student is expected to work on the project both individually and under the guidance of a supervisor. An engineering project involves the creative application of scientific principles to the solution of a technical problem. It involves a problem description or research hypothesis developed in consultation with a supervisor, reviewing the topic in detail and defining the boundaries (scope) carefully, confirming an understanding of the requirements of the supervisor, searching for, selecting and justifying the most appropriate approaches to solving the problem or testing the hypothesis. It also requires a student to be able to analyze, design, build, integrate and test as is appropriate for the specific project. This could include the use of hardware, software and simulation. Students are also required to evaluate the project against the success criteria and design objectives, and to write a report about the project, the findings, and any recommendations. In addition, students need to make an oral presentation and prepare an exhibit.		
Assessment	Thesis 100%		
DP Requirement	Meeting the ELO requirements		

Degree Module Content for 3rd year and 4th year Mechanical Engineering

Title	**Mechanics of Solids II**		
Code	**5MECH311**	**Department**	**Mechanical Engineering**
Prerequisites	**5MEC211**	**Co-requisites**	**None**
Aim	Solid Mechanics is the study of load carrying structures in terms of forces, deformations, and stability. The main objective is to develop the skills that will allow students to understand materials. under different loading conditions.		
Content	**Strain Energy and Theories of Failure** Understanding combined loading conditions and formulating point of failure. Failure theories including maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, maximum shear strain energy theory, Coulomb-Mohr shear stress theory. Determination of component failure using elastic failure theories. **Deflection using Castigliano's Energy Method.** Calculation of beam deflection using Energy Methods, for different loading conditions. **Thin and thick cylinders** Understanding and calculation of the stresses developed in vessels under pressure, shrink fits and compound cylinders. **Strains beyond the elastic limit** Understanding of material behaviour beyond its yield stress where deformation is permanent and non-reversible. Calculation of additional load capacity when considering plasticity. **Rotating discs** Understanding the stresses developed in discs under rotary motion. **Two laboratory sessions on tensile testing and loading of structures**.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	**Thermofluids II**		
Code	**5MEC321**	**Department**	**Mechanical Engineering**
Prerequisites	**5MEC212**	**Co-requisites**	**None**
Aim	The Module consists of two topics, Thermodynamics and Fluid Dynamics. The main objectives are to develop the skills that will allow students to solve engineering problems and also to communicate the outcomes of a laboratory session in a report.		
Content	Different types of flow. ▪ Application of the conservation of mass in fluid flow. ▪ Application of the conservation of momentum in fluid flow. ▪ Application of the conservation of energy in fluid flow. ▪ Application of dimensional analysis and similarity for reduced • Experimentation and scaling. ▪ The velocity of pressure waves in fluids. ▪ Laminar and turbulent flows in pipe flows. Revision of basic concepts: ○ energy ○ properties of pure substances ○ energy analysis of closed systems ○ mass and energy analysis of control volumes. ○ Constant volume and constant pressure processes ○ enthalpy Second Law of Thermodynamics, heat source and sink, thermal efficiency, perpetual motion machines, reversible and irreversible processes, Carnot efficiency, Carnot refrigeration cycle, entropy, isentropic processes. Efficiency of compressors, steady flow devices, isothermal, polytropic and isentropic processes, isentropic efficiencies for turbines, compressors, pumps and nozzles. Gas cycles: ○ Otto, ○ Diesel, ○ Stirling, ○ Ericsson, ○ Brayton and jet-propulsion cycles. Vapour and combined cycles: ○ Rankine cycle: ▪ reheat, ▪ regeneration, ▪ co-generation, ○ Refrigeration cycles: ▪ vapour-compression cycles, heat pumps, absorption refrigeration (basic concept) Gas and vapour mixtures, psychrometric charts. (basic concept)		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Mechanical Engineering Machine Element Design II		
Code	**5MEC331**	**Department**	**Mechanical Engineering**
Prerequisites	**5MEC232**	**Co-requisites**	**None**
Aim	To introduce students to machine design methods.		
Content	This Module aims to facilitate the development of knowledge and skills that will allow students to address design problems with both creativity and rigor, by generating concept designs, designing machine components and assemblies that will perform and can be produced in accordance with appropriately specified development requirements, and the creation of suitable engineering drawings for parts and assemblies. Topics include: Concept generation, machine component design and basic machine system design, CAD modelling and creation of part and assembly drawings including tolerances. Specific knowledge areas are static and fatigue failure theories; standard machine design for joints (welding, threaded and non-threaded fasteners), and power screws and includes basic design projects on the machine level.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Statistics for Engineers		
Code	**4STT171**	**Department**	**Mathematical Sciences**
Prerequisites	**4MTH171, 4MTH172**	**Co-requisites**	**None**
Aim	This Module aims to introduce engineering students to the basic concepts and tools of Statistics which are of particular relevance in an engineering context, and to enable students to apply these to data collected from engineering experiments.		
Content	Topics include: Random variables, sampling and basic statistical measures; Normal, t, F and Chi-square distributions; Confidence intervals; Statistical models, such as the means and the effects models; t, F and Chi-square tests; Regression and correlation; One-way analysis of variance; Introduction to the design of experiments; Application of statistical tools to experimental data in an engineering setting.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Experimental Methods		
Code	**5MEC341**	**Department**	**Mechanical Engineering**
Prerequisites	**All second year modules**	**Co-requisites**	**None**
Aim	This Module aims to develop skills, based on a real-world scenarios and case studies, which will allow a student to perform successful engineering experiments, as well as data analysis and interpretation.		
Content	The Module covers topics such as: basic concepts in experimental methods and taking measurements; safety and risk assessment; uncertainty analysis; basic electrical measurements; sensing and data management; temperature, pressure, force, strain and flow measurement devices; basic design of experiments and orthogonal arrays; nondestructive evaluation of parts; multi- component experimental case studies.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Materials under stress		
Code	5MEC351	Department	Mechanical Engineering
Prerequisites	5MEC221	Co-requisites	None
Aim	This Module in materials under stress aims to develop an advanced understanding of elasticity and the importance of modulus in engineering design.		
Content	Topics include: the influence of bond strength and crystal structure; plastic flow in crystals and polycrystals by dislocation movement; strengthening mechanism in metals and alloys; annealing and heat treatment procedures; design for safety; stress concentration and residual stress considerations; failure in metals; ductile and brittle fractures; critical flaw size for crack propagation; fracture toughness of materials; stress conditions for fatigue and creep deformation; fracture mechanics; and failure analysis and failure case studies.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Mechanical Engineering Machine Element Design III		
Code	5MEC312	Department	Mechanical Engineering
Prerequisites	5MEC331(DP)	Co-requisites	None
Aim	This Module aims to facilitate the further development and skills that will allow students to address complex design problems with creativity and rigor.		
Content	The aims will be achieved by generating and selecting concept designs, performing etailed design of machine components and assemblies that will perform and can be produced in accordance with appropriately specified development requirements. The communication of the design process with design reports including engineering drawings is also covered in the Module.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Dynamics II		
Code	5MEC322	Department	Mechanical Engineering
Prerequisites	5MEC222	Co-requisites	None
Aim	This Module provides an introduction to engine balancing, kinematic analysis of gear trains, energy storage in flywheels and single-degree-of-freedom models in vibration analysis. Students will learn to analyze the dynamic behaviour of common engineering systems and components, for example gear trains, rotating and reciprocating machinery, flywheels and gyroscopes		
Content	**Gears:** Gear types: spur, bevel, helical, worm; transmission ratio and efficiency; epicyclic gears and differentials **Vibrations:** Free and forced vibration, viscous damping, Single-degree-of-freedom systems Resonance **Rotating Unbalance:** Static balancing, Dynamic balancing, examples of balancing in Practice **Engine Balancing:** Components of an engine, Determination of unbalanced forces and couples, Single cylinder engines, Multi-cylinder engines V- engines **Flywheels:** Energy storage; pulse smoothing torque and speed fluctuations,Crank-effort diagrams, applications - engines and pressing operations **Gyroscopes:** Gyroscopic motion; steady precession only **Laboratory Sessions:** Epicyclic gearbox, Rotating Unbalance		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Thermofluids III		
Code	5MEC332	Department	Mechanical Engineering
Prerequisites	5MEC321(DP)	Co-requisites	None
Aim	This Module aims to develop an advanced understanding of thermofluids.		
Content	Topics include: Boundary layer theory; forced and natural convection (laminar and turbulent flow along plates and tubes); compressible flow in pipes; rotodynamics machines. ; gas power cycles, engine cycles and measures of performance; properties of gas and vapour mixtures; air-conditioning; combustion chemistry; air/fuel ratio and stoichiometry; fuel sources and composition; energy of reacting systems; heat of combustion; adiabatic flame temperature; heat exchangers; and availability		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Project Management		
Code	5MEC 242	Department	Mechanical Engineering
Prerequisites	All 2nd year modules	Co-requisites	None
Aim	This module deals with the theory, tools, techniques and practices in project management. Opportunities are provided to develop an understanding of the triangle of Project Management (PM) – time, cost and performance and to use PM techniques to achieve objectives within triangle constrains. The application of the theory, tools, techniques and practices is an objective. This takes the form of a multidisciplinary project i.e. development of a small scale engineering system.		
Content	Introduction to Project Management Introduction to Project Planning and Life Cycle Project Scope Management Project Time Planning and Network Costing Project and Financial Statement Managing Project Resources Managing Risk in Projects Project Quality Management Project Human Resource Project Contracts Trade-off Analysis in a Project Environment Project Closeout Tools include, but are not limited to, WBS, CPM, Gantt Chart, Resource Levelling, Cash Flow Statement, Trade- off analysis and communication techniques		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Professional Communication Studies		
Code	5MEC342	Department	Mechanical Engineering
Prerequisites	All second year modules	Co-requisites	None
Aim	The aim of the Module is to equip students with theory of oral and written communication, and to give them practical skills that will enable them to communicate more effectively at the University and in their professional careers		
Content	Referential Style and Academic writing and presentation; Planning & Discourse of technical written and oral messages; Reports – investigative/ evaluative; Executive Summaries/ Synopses; Individual presentations; graphics and visual literacy. Module content covers the following areas: Communication theory: • aim of communication • barriers to communication • audience and readership analysis • modes of communication Planning and Discourse: • definitions and schools • reasons for codes and rules • professional practice as defined by ECSA • corporate governance and King III report Reports: • types: investigative and feasibility • research: citation and referencing • different formats for types of reports • sections within reports (introduction, methods, results, conclusions, recommendations) and their functions • preliminary sections such as Table of Contents • final sections such as Appendices Summaries: • purpose of an executive summary to a technical or professional report • structure and components of a good executive summary • style and language for a persuasive and comprehensive summary Graphic and PowerPoint Design: • fundamental principles of visual literacy for text documents and presentations • types of graphics • types of visual aids that support and enhance a good presentation • visual literacy and creating PowerPoint slides. Individual presentations: • criteria for giving an effective oral presentation • vocal delivery • techniques for planning and balance in a presentation • audience reach • managing questions		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Culture and Society in Africa		
Code	1ANT172	Department	Social Anthropology
Prerequisites	None	Co-requisites	None
Aim	This is a Complementary Studies Module for Electrical Engineering students aimed at broadening student's perspective.		
Content	Culture and Society in Africa provides students from all faculties with background knowledge about the continent on which they live. The module includes an examination of the concepts of culture, race, society, ethnicity and nation-state, a perspective on African worldviews and ways of thought, and a consideration of the role of Africa in a changing world.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Mechanical Vibrations		
Code	5MEC411	Department	Mechanical Engineering
Prerequisites	5MEC322	Co-requisites	None
Aim	This Module aims to introduce students to the modelling of vibration in machines and structures. This will include single- and multi- degree of freedom models; analytical and numerical solution techniques; and practical applications. Formulation of equations of motion for single- and multi- degrees of freedom by Newton's laws and energy methods; solution techniques for equations of motion via analytical and numerical methods; modal analysis; application of techniques to analysis and design; and continuous systems.		
Content	1. Single degree of freedom systems: 1.1 Formulation of the equation of motion of linear SDOF system by a) Newton's Law b) Energy Method(s) 1.2 Solution of equation of motion by: a) Analytical solutions b) Numerical methods 1.3 Applications: Rotating unbalance, vibration isolation, vibration measurement 2. Multi degree of freedom systems: 2.1 Formulation of the equation of motion of linearized DMOF system a) Analytical solutions b) Numerical methods 2.2 Solutions of equations of motion for free and forced systems by a) Modal analysis b) Numerical methods c) Application: Vibration absorbers, complex structures, mechanisms 2.3 Continuous Systems (Time Allowing) 3. Formulation of equations of motion for simple continuous systems 4. Vibration absorbers		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Product Design		
Code	5MEC421	Department	Mechanical Engineering
Prerequisites	5MEC312	Co-requisites	None
Aim	To facilitate the development of knowledge and skills that will allow candidates to design a conventional engineering device working in a team and individually. The design is to be performed holistically, duly considering market opportunities and product architecture, needs identification, requirement formulation, planning and managing the process, concept generation and selection, detail design and drawing, financial and technical performance analysis and communicating the design solution.		
Content	• The Design Process (Ulrich & Eppinger, Chapter 2) • Opportunity identification (Ulrich & Eppinger, Chapter 3) • Product planning and architecture (Ulrich & Eppinger, Chapters 4 & 10) • Customer needs and requirements specification (Ulrich & Eppinger, Chapters 5 & 6) • Concept generation and selection (Ulrich & Eppinger, Chapters 7 & 8) • Managing projects (Ulrich & Eppinger, Chapters 18) • Product development economics (Ulrich & Eppinger, Chapter 17) • Design for Environment, Manufacture and Assembly (Ulrich & Eppinger, Chapters 12 & 13) • Prototyping and modelling (Ulrich & Eppinger, Chapter 14) • Patents and Intellectual Property (Ulrich & Eppinger, Chapter 16) • Industrial design (Ulrich & Eppinger, Chapter 11) • Robust design (Ulrich & Eppinger, Chapter 15) • Design project (Afternoon session plus own time)		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Finite Element Analysis		
Code	5MEC431	Department	Mechanical Engineering
Prerequisites	5MEC311	Co-requisites	None
Aim	This Module introduces the formulation and application of the finite element analysis (FEA) in the context of structural and stress analysis.		
Content	The content will focus on 2-D formulations, with reference to the conceptual approach to 3-D problems. The aim is to integrate both theory and practice into a coherent whole. To this end, the fundamental theory is addressed in detail and students will be required to implement the finite element method in a spreadsheet macro and/or MATLAB programme. Topics include: Element Stiffness Matrix; Global Stiffness Matrix; Boundary Conditions; Unit Displacement Method; Principle of Minimum Potential Energy; Truss, Beam and Frame Elements in 2D; Interpolation; Constant Strain Triangle, Isoparametric Formulation; Gauss Quadrature; Quadrilateral Elements; Shear Locking.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Industrial Ecology		
Code	5MEC410	Department	Mechanical Engineering
Prerequisites	All third year modules	Co-requisites	None
Aim	The module is an introduction and overview of the relatively new 'field' of Industrial Ecology and its more recent trends. In the context of the module "industrial ecology" is interpreted as encompassing all of the interactions of an industrial society with the natural environment as well as the associated drivers of industrialization. A more appropriate way of thinking about the module is to rename it "the Ecology of Industrial Society". The objectives are to encourage a systems perspective of industrial activity as it is integrated with and forms part of the natural systems (lithosphere, pedosphere, biosphere, hydrosphere, atmosphere) This module is intended to be an enjoyable and enlightening experience, given the very different kind of learning that is expected. The students in the class have the responsibility to make the learning their own – to engage in debate and ask questions that will lead to the class finding out new information and reading different literature than that originally proposed – because it concerns what interests you and what you want to learn. What you learn and the effects of industry on the environment both affect your future. We are all in this together – the learning and the living. Let's do it with enthusiasm and meaning. There are however, two primary educational goals for the module. The first has to do with the content and the second with the process. Students are expected to become aware of the problem issues facing the global community that relate to the industrial impact on the environment – the ecology of industrial society. You are expected to demonstrate this awareness and the acquisition of knowledge and understanding through discussion in class, through oral arguments, quizzes, projects, an exam and a term paper. These forms of communication hint at the second set of outcomes that relate to the ability to accomplish a limited kind of research as well as communicating ideas in a professional manner. Students are expected to put into practice the skills they have acquired in their professional communication module as well as using the opportunity to improve those skills. These do not only relate to the presentation side of the skills but also to the exploratory and critical aspects – being able to ask critical questions, seek information from the internet and other sources, argue a case in discussion as well as in a formal written presentation, show logical development of a debate and a willingness to be persuaded by a counter argument.		
Content	Ecosystem deterioration, pollution Resource depletion: Fossil fuels, water, uranium, rare earth metals Climate change Systems thinking, thermodynamics Sustainability; the limits to growth Industrial Ecology concepts and tools Material Flow Analysis Life Cycle Assessment; the circular economy Design for Environment Eco-Industrial Parks: industrial symbiosis Ethics: economic paradigms, consumption Energy, Mobility,		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	**Fundamentals of Control Systems**		
Code	**5MEC441**	**Department**	**Mechanical Engineering**
Prerequisites	**All third year modules**	**Co-requisites**	**None**
Aim	The objective of this Module is to provide an introduction to basic techniques in control systems engineering: ▪ Mathematical modelling of elementary systems; ▪ converting governing linear differential equations by means of the Laplace transform; ▪ transfer functions and block diagram algebra; the root locus technique for stability analysis; frequency response of systems; ▪ Bode plot design of control loops; ▪ the effect of proportional, integral and derivative control; ▪ z-transforms and difference equations for digital control; • control system computer simulations.		
Content	• Basic control loops, benefits of feedback, transfer functions • Block diagram algebra • Laplace (s-) transforms • Z-transforms • Accurate and approximate s-z relations • Simulations • Delays in control loops, compensators, noise and filters • Bandwidth, Time constant, Gain and Phase revisited • Importance and meaning of poles and zeros – analyses and demonstration by simulation • Root Locus analysis – manual calculations and sketching, computer generated • Comparing Root Locus and Bode Plots • Bode Plot analysis and design, open loop, closed loop • Optimal compensator positions • From analogue to digital – revision and expansion • From digital to implementation – difference equations • Bode Plot design – digital / analogue mixed • Quantization effects, stiction / friction and noise • Noise filtering, especially anti-aliasing • Scaling • Modelling of DC motors, gearboxes and sensors • Examples of complete systems – specifying, modelling, simulation, design		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Engineering Professionalism		
Code	**5MEC451**	**Department**	**Mechanical Engineering**
Prerequisites	**All third year modules**	**Co-requisites**	**None**
Aim	This module deals practically with the student's transition to the workplace. The aim is to complement the student's theoretical training by introducing (in some cases) and reinforcing (in others) the topics and issues most likely to be encountered in the engineering profession. This is part of the endeavour to produce a well-rounded mechanical engineer for industry, consulting and the design environment		
Content	Professional registration – ECSA, the Washington Accord, code of conduct, due diligence, government certificate of competence, mentorship in industry. Types of engineering employment – details of the options available for graduates, the realities of the workplace and industry training, career path management. Engineering economics – working capital, cash flow, salaries and wages, depreciation, tax considerations, rate of return, payback period. Health and Safety – managing disease and health in the workplace, occupational safety and related legislation, practical HAZOP analysis, safe work permits and lockouts. Industrial law – Overview of employment law, labour relations and employment equity contracts, basis of offer and acceptance. Quality, reliability and maintenance management and their importance in the engineering profession. Environment – legislation, ISO140001, aspects of engineering operations and likely impacts, considerations of the created environment as well as the impacts on socio-economic and cultural systems.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	System Design		
Code	**5MEC412**	**Department**	**Mechanical Engineering**
Prerequisites	**5MEC421(DP)**	**Co-requisites**	**None**
Aim	The objective of the Module is to enable students to structure and plan a high level system design and to generate system and subsystem development specifications. Structuring of the development process according to the life cycle model portrayed by the V-diagram. Functional decomposition and allocation to hardware. Determination of the system and subsystem requirements by means of system modelling and simulation and creation of a system verification matrix.		
Content	This Module marks the final chapter in the design programme that covers 3 years of undergraduate engineering studies. Students are now ready to tackle engineering problems that stretch beyond disciplinary boundaries, and involve complexity that is beyond the mastery of a single engineer. This is the world of Systems Engineering where various processes and techniques are used to make a seemingly impossible problem manageable and solvable. From the previous design Modules students have learned the skills of component or product design. Now it is time to broaden the horizons and tackle systems containing several interrelated products. The fundamental skills from mathematics, physic thermofluids, dynamics and other subjects will be essential for students to master the subject of System Design. The aim of this Module is to give students an appreciation of the effort and methodologies used when developing large and complex systems like power plants, aircraft, vehicles, space stations or even transportation networks.		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	New Venture Planning and Management		
Code	5MEC422	Department	Mechanical Engineering
Prerequisites	All third year modules	Co-requisites	None
Aim	Learning Business skills involved in starting entrepreneurial businesses from products designed: feasibility analysis, business plan, presentations		
Content	The entrepreneurial perspective; developing a new venture; what is a feasibility plan? Product concept and description; market assessment; industrial analysis; marketing plan; operations, development plans and management; financial projections		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Maritime Law for Engineers		
Code	2LMA472	Department	Physics and Engineering
Prerequisites	All third year Modules	Co-requisites	None
Aim	To empower students to understand, analyse, research, discuss, explain, evaluate, give advice concerning, and generally deal with Maritime Law - and internet related legal and policy issues.		
Content	Maritime law remains in many ways a truly international field of law. The United Nations, the International Maritime Organization, and other international bodies like the Comitè Maritime International have been instrumental in bringing into force a number of international conventions in the field of shipping, carriage of goods by sea, safety of life at sea, and the marine environment. The focus of this Module will be on those Conventions which have been ratified or adopted by South Africa as part of our domestic law. One sometimes hears the distinction made amongst maritime lawyers between "wet" and "dry" shipping work. "Wet work" relates primarily to incidents of navigation – that is problems that occur with ships at sea- such as collisions, unseaworthiness, salvage, towage, and oil spills. Dry work refers to the carriage of goods by sea and involves a study of the contracts involved and litigation of the claims that arise from the loss or damage to the cargo carried on board. In this area of maritime law, the student must understand the inter-relationship between the contracts of carriage, the international sale contract, the marine insurance contract, and international finance. Thus maritime law intersects and overlaps other areas of study such as international trade, insurance, sale, tax and banking. Students will only be taught some of the basic concepts in this module, but will also be given a helpful overview of "the bigger picture".		
Assessment	Continuous Assessment 40% Examination 60%		
DP Requirement	40% Continuous assessment mark 80% Attendance at practical's		

Title	Final Year Research Project		
Code	5MEC432	Department	Mechanical Engineering
Prerequisites	Depends on the topic	Co-requisites	None
Aim	To give individual students the opportunity to tackle a real engineering project within a limited period under the guidance of a supervisor and submit a project report on the results.		
Content	The final year research project is an important opportunity for the student, at the end of the degree programme, to tackle a real engineering project. The student is expected to work on the project both individually and under the guidance of a supervisor. An engineering project involves the creative application of scientific principles to the solution of a technical problem. It involves a problem description or research hypothesis developed in consultation with a supervisor, reviewing the topic in detail and defining the boundaries (scope) carefully, confirming an understanding of the requirements of the supervisor, searching for, selecting and justifying the most appropriate approaches to solving the problem or testing the hypothesis. It also requires a student to be able to analyse, design, build, integrate and test as is appropriate for the specific project. This could include the use of hardware, software and simulation. Students are also required to evaluate the project against the success criteria and design objectives, and to write a report about the project, the findings, and any recommendations. In addition, students need to make an oral presentation and prepare an exhibit.		
Assessment	Thesis 100%		
DP Requirement	Meeting the ELO requirements		