Electrical Engineering

Bachelor of Science in Engineering in Electrical and Computer Engineering 4-year curriculum

BSc(Engineering)(Electrical and Computer Engineering)[EB022EEE02]

Associate Professor and Programme Convener:
AJ Wilkinson, BSc(Eng) *Cape Town* PhD *London*

Electrical and Computer Engineering is an interdisciplinary branch of engineering which combines a fundamental study in electrical engineering with computing. Many universities and other institutions world-wide are now offering courses or degrees in Electrical and Computer Engineering, and it is recognised that the combination of electrical engineering and computer studies equips graduates with an excellent basis upon which valuable engineering roles in modern industry can be built. Apart from receiving a thorough grounding in both electrical engineering and computing, the Electrical and Computer Engineering student at UCT gains a foundation of understanding in physical science, advanced engineering mathematics, microcomputer technology and systematic engineering design.

Electrical and Computer engineers in industry generally possess expertise across a broad range of engineering disciplines, and are especially well-suited to a career in network engineering, control & instrumentation, power systems or telecommunications. Electrical and Computer engineers may also become involved in diverse fields such as bio-medical engineering, machine vision, power electronics and machines, or signal and image processing.

The Electrical and Computer Engineering programme is administered as a distinct programme within the Department of Electrical Engineering, and advice specific to the needs of Electrical and Computer Engineering undergraduates is available to students enrolled in the programme.

A candidate shall complete approved courses of a value not less than 576 credits and shall comply with the prescribed curriculum requirements.

First Year Core Courses (EC)

Code	Course	NQF Credits	HEQSF Level
CSC1015F	Computer Science 1015	18	5
EEE1006F	Introduction to Electronic Engineering	12	5
MAM1020F	Mathematics IA for Engineers	18	5
MEC1003F	Engineering Drawing	8	5
PHY1012F	Physics A for Engineers	18	5
AXL1200S	Culture, Identity & Globalisation in Africa	8	5
CSC1016S	Computer Science 1016	18	5
EEE1007S	Introduction to Electrical Engineering	12	5
MAM1021S	Mathematics IB for Engineers	18	5
PHY1013S	Physics B for Engineers	18	5
EEE1000X	Practical Training	0	5
	Total credits per year	**148**	

Second Year Core Courses (EC)

Code	Course	NQF Credits	HEQSF Level
EEE2045F	Analogue Electronics	16	6
EEE2046F	Embedded Systems I	16	6
EEE2048F	Professional Communication for Electrical Engineering	8	6
MAM2083F	Vector Calculus for Engineers	16	6
MEC1009F	Introduction to Engineering Mechanics	16	5
EEE2044S	Introduction to Power Engineering	16	6
EEE2047S	Signals and Systems I	16	6
MAM2084S	Linear Algebra and DEs for Engineers	16	6

MEC2026S	Project Management	8	6
PHY2010S	Electromagnetism for Engineers	16	6
	Total credits per year	**144**	

Third Year Core Courses (EC)

Code	Course	NQF Credits	HEQSF Level
CSC2001F	Computer Science 2001	24	6
EEE3088F	Electrical Engineering Design Principles	8	7
EEE3089F	Electromagnetic Engineering	16	7
EEE3090F	Electronic Devices and Circuits	16	7
EEE3092F	Signals & Systems II	16	7
EEE3096S	Embedded Systems II	16	7
EEE3097S	Engineering Design: Electrical & Computer Engineering	8	7
EEE3000X	Practical Training	0	7
	Approved Complementary Studies Elective F/S	16	

Third Year Elective Core Courses (EC)

Select two out of the following three courses. Your choices will have an impact on which 4th year electives can be taken the following year.

Code	Course	NQF Credits	HEQSF Level
CSC2002S	Computer Science 2002	24	6
EEE3093S	Communication & Network Engineering	16	7
EEE3094S	Control Systems Engineering	16	7
	Total credits per year (minimum)	**152**	

Note: All three elective 3rd year core courses can be taken, but then the complementary studies elective must be taken in the winter or summer term.

Fourth Year Core Courses (EC)

Code	Course	NQF Credits	HEQSF Level
EEE4113F	Engineering System Design	16	8
CML4607Z	Law for Engineers	8	8
EEE4006C	Professional Communication Studies	8	8
EEE4051C	New Venture Planning	8	8
MEC4063C	Industrial Ecology	8	8
EEE4022S	Final Year Project	40	8

Fourth Year Elective Core Courses (EC)

Select courses amounting to at least 48 credits from the following:

At least two courses from:

Code	Course	NQF Credits	HEQSF Level
EEE4118F	Process Control & Instrumentation	16	8
EEE4120F	High Performance Digital Embedded Systems	16	8
EEE4121F	Mobile and Wireless Networks	16	8

And further courses from:

Code	Course	NQF Credits	HEQSF Level
EEE4086F	Microwave Engineering	16	8
EEE4114F	Digital Signal Processing	16	8
EEE4122C	Communication Engineering	8	8
EEE4123C	Electrical Machines & Drives	8	8
CSC3xxx	Approved 3rd year Computer Science course	24	7
HUB4045F	Introduction to Medical Imaging & Image Processing	12	8
	Total credits per year (minimum)	**140**	

The following courses may be of interest, timetable permitting, and require approval:

Code	Course	NQF Credits	HEQSF Level
EEE4115F	Power Distribution & Transmission Networks	16	8
EEE4116F	Power Systems Analysis, Operation and Control	16	8

Code	Course	NQF Credits	HEQSF Level
EEE2051L	Practical Electronics, Components, Modules & Design	8	6
END1019L	Social Infrastructures: Engaging with community for change	18	5
HUB2005F	Introduction to Medical Engineering	8	6

Bachelor of Science in Engineering in Electrical and Computer Engineering 5-year curriculum

BSc(Engineering)(Electrical and Computer Engineering)[EB822EEE02]

Associate Professor and Programme Convener:
AJ Wilkinson, BSc(Eng) *Cape Town* PhD *London*

Students on the 5-year curriculum take the same courses and credits as in the 4-year curriculum, but the courses are spaced out over 5 years to allow more time for learning new concepts, grappling with assignments, asking questions, and obtaining feedback. The 5-year curriculum is supported by ASPECT to ensure student success.

All students are admitted into the 4-year curriculum, and there are two opportunities in the first year to change to the 5-year curriculum and receive additional support from ASPECT. The first opportunity is after the initial set of class tests in the first term. The second opportunity is after the first semester's final examinations.

There are no additional tuition fees or charges for changing to the 5-year curriculum. Changing at the end of the first term is preferable as this enables students to switch before any courses are failed. Courses that are failed must be repeated and will be charged for.

A candidate shall complete approved courses of a value not less than 576 credits and shall comply with the prescribed curriculum requirements.

First Year Core Courses (EC)

Code	Course	NQF Credits	HEQSF Level
EEE1006F	Introduction to Electronic Engineering	12	5
MAM1023F	Mathematics IA for Engineers Extended	18	5
PHY1014F	Physics A for ASPECT	18	5
EEE1007S	Introduction to Electrical Engineering	12	5
MAM1024S	Mathematics IB for Engineers Extended	18	5
PHY1015S	Physics B for ASPECT	18	5
	Total credits per year	**96**	

Second Year Core Courses (EC)

Code	Course	NQF Credits	HEQSF Level
CSC1015F	Computer Science 1015	18	5
EEE2045F	Analogue Electronics	16	6
MAM2085F	Vector Calculus for ASPECT	16	6
MEC1003F	Engineering Drawing	8	5
CSC1016S	Computer Science 1016	18	5
EEE2047S	Signals and Systems I	16	6
MAM2084S	Linear Algebra and DEs for Engineers	16	6
MEC2026S	Project Management	8	6
EEE1000X	Practical Training	0	5
	Total credits per year	**116**	

Third Year Core Courses (EC)

Code	Course	NQF Credits	HEQSF Level
CSC2001F	Computer Science 2001	24	6
EEE2046F	Embedded Systems I	16	6
EEE2048F	Professional Communication for Electrical Engineering	8	6
MEC1009F	Introduction to Engineering Mechanics	16	5
AXL1200S	Culture, Identity & Globalisation in Africa	8	5
EEE2044S	Introduction to Power Engineering	16	6
PHY2010S	Electromagnetism for Engineers	16	6
	Approved Complementary Studies Elective F/S	16	
	Total credits per year	**120**	

Fourth Year Core Courses (EC)

Code	Course	NQF Credits	HEQSF Level
EEE3088F	Electrical Engineering Design Principles	8	7
EEE3089F	Electromagnetic Engineering	16	7
EEE3090F	Electronic Devices and Circuits	16	7
EEE3092F	Signals & Systems II	16	7
CML4607Z	Law for Engineers	8	8
EEE3096S	Embedded Systems II	16	7
EEE3097S	Engineering Design: Electrical & Computer Engineering	8	7
EEE3000X	Practical Training	0	7

Fourth Year Elective Core Courses (EC)

Select two out of the following three courses. Your choices will have an impact on which 4th year electives can be taken the following year.

Code	Course	NQF Credits	HEQSF Level
CSC2002S	Computer Science 2002	24	6
EEE3093S	Communication & Network Engineering	16	7
EEE3094S	Control Systems Engineering	16	7
	Total credits per year (minimum)	**120**	

Fifth Year Core Courses (EC)

Code	Course	NQF Credits	HEQSF Level
EEE4113F	Engineering System Design	16	8
EEE4006C	Professional Communication Studies	8	8
EEE4051C	New Venture Planning	8	8
MEC4063C	Industrial Ecology	8	8
EEE4022S	Final Year Project	40	8

Fifth Year Elective Core Courses (EC)

Select courses amounting to at least 48 credits from the following:

At least two courses from:

Code	Course	NQF Credits	HEQSF Level
EEE4118F	Process Control & Instrumentation	16	8
EEE4120F	High Performance Digital Embedded Systems	16	8
EEE4121F	Mobile and Wireless Networks	16	8

And further courses from:

Code	Course	NQF Credits	HEQSF Level
EEE4086F	Microwave Engineering	16	8
EEE4114F	Digital Signal Processing	16	8
EEE4122C	Communication Engineering	8	8
EEE4123C	Electrical Machines & Drives	8	8
CSC3xxx	Approved 3rd year Computer Science course	24	7

Code	Course	NQF Credits	HEQSF Level
HUB4045F	Introduction to Medical Imaging & Image Processing	12	8
Total credits per year (minimum)		**132**	

The following courses may also be of interest, timetable permitting, and require approval:

Code	Course	NQF Credits	HEQSF Level
EEE4115F	Power Distribution & Transmission Networks	16	8
EEE4116F	Power Systems Analysis, Operation and Control	16	8
EEE2051L	Practical Electronics, Components, Modules & Design	8	6
END1019L	Social Infrastructures: Engaging with community for change	18	5

Course descriptions are set out in the section on Departments in the Faculty and Courses Offered. The course code abbreviation for Electrical Engineering is EEE.

Access for University of Technology Transferees

Students who have completed a National Diploma or Bachelor of Technology Degree in Engineering in minimum time and with a grade average of at least 70% and a minimum of 75% for Mathematics courses will be considered for entry into the Electrical Engineering, Electrical and Computer Engineering and Mechatronics degree programmes. Students must have qualified for matriculation exemption or the NSC endorsed for degree studies prior to commencement of the ND programme. Credits and exemptions may be granted on a course by course basis, but students must complete all the core and elective core courses, or their equivalent, prescribed for the degree and pass at least 288 credits at UCT, resulting in a total credit value of at least 576 credits. All students need to meet the knowledge and learning outcomes specified by ECSA.

Course Outlines

EEE1000X PRACTICAL TRAINING
0 NQF credits at HEQSF level 5
Convener: Mr D de Maar
Course outline:
This opportunity for practical experience culminates in a certificate showing evidence of completion of suitable work in the basic workshop processes to the satisfaction of the Head of Department, during a period of at least six weeks in an approved workshop, either before registration or during the long vacation following the year of first registration in the faculty (due by 31 March of the following year). Alternatively students may produce a certificate showing evidence of completion of an approved structured intensive practical training course of at least 3 weeksduration.
DP requirements: Not applicable.

EEE1006F INTRODUCTION TO ELECTRONIC ENGINEERING
12 NQF credits at HEQSF level 5
Convener: Dr R Smit
Course outline:
This course aims to motivate and help students understand the nature and scope of electronic engineering by providing an introduction to the content, methods and modes of thinking. A further aim is to develop students' confidence in rational problem-solving approaches and to introduce students to the design process. Topics include: Current, Voltage and Power, Resistors, Kirchhoff's Laws, Resistors used for Sensing, Capacitors, Capacitors as Sensors, Diodes, The Bipolar Junction Transistor (BJT) and BJT circuits, Metal Oxide Semiconductor Field Effect Transistors (MOSFETs), Digital Integrated Circuits, gates, flip flops and counters, Analog Integrated Circuits, operational amplifier and comparator circuits, Mixed Signal Integrated Circuit, the NE555.
Lecture times: Mon, Tues, Wed, Thurs 3rd period
DP requirements: 80% Lab and tutorial attendance; 100 % attendance at all class tests
Assessment: Labs: 5% Tests: 25%, June Examination: 70%

EEE1007S INTRODUCTION TO ELECTRICAL ENGINEERING
12 NQF credits at HEQSF level 5
Convener: Dr R Smit
Course outline:
This course aims to motivate and help students understand the basic concepts of power generation, transmission, distribution, nuclear energy and renewable energy, power utilization in common electric appliances and basic principles of electric circuits and networks. A further aim is to develop students' confidence in rational problem-solving approaches, in performing laboratory exercises and to introduce students to the design process. Topics include power generation, transmission, distribution and utilization, DC networks, inductance and capacitance, circuit transients, fundamentals of AC and single phase AC circuits

Lecture times: Mon, Tues, Wed, Thurs, 3rd period
DP requirements: 80% Lab and tutorial attendance; 100% attendance test attendance
Assessment: Design Project: 10%, Lab Test 5%, Tests: 20%, November Examination: 65%

EEE2041F INTRODUCTION TO ELECTRICAL ENGINEERING & POWER UTILISATION

For students in the Mechanical Engineering and Mechanical & Mechatronic Engineering programmes.
16 NQF credits at HEQSF level 6
Convener: Associate Professor S Chowdhury
Course entry requirements: PHY1013F/S, MAM1021S
Course outline:
The course aims to help students understand: (a) DC Networks including DC circuits, series and parallel connection, Kirchhoff's laws, Mesh Analysis, DC Network theorems (Thevenin, Norton, etc); (b) Fundamentals of AC including generation, concepts of waveform, period, frequency, angular velocity, phase etc., average, peak and RMS values; (c) Single Phase AC Circuit including AC through resistance (R), inductance (L) and capacitance (C), concept of reactance and impedance, phasors, single-phase AC series and parallel circuits, concept of active power, reactive power, apparent power and power factor; (d) Simple Magnetic Circuits including definition of magnetic circuits, simple and composite magnetic circuits, magnetic circuit calculations, magnetic hysteresis, core loss, sinusoidal excitation of magnetic circuits and induced voltage; (e) Single-phase Transformers including core construction, principle of operation, e.m.f. equation and transformation ratio, no-load and on-load operation, phasor diagram under no-load and full-load operation with lagging and leading loads, exact and approximate equivalent circuits, open and short circuit tests, losses and efficiency, voltage regulation. (f) Three-phase systems (g) electrical loads and tariffs; (h) DC machines including motors and generators briefly.
Lecture times: Mon, Wed, Thurs, Fri, 5th period
DP requirements: 100% Laboratory attendance. 80% tutorial attendance and 50% mark for laboratories.
Assessment: Lab (10%), Class Test (30%), June Examination (60%)

EEE2042S INTRODUCTION TO ANALOGUE AND DIGITAL ELECTRONICS

For students in the Mechanical Engineering and Mechanical & Mechatronic programmes.
8 NQF credits at HEQSF level 6
Convener: Associate Professor O Falowo
Course entry requirements: MAM1021F/S, PHY1013F/S, DP for EEE2041F.
Course outline:
The course aims to help students understand the following concepts: (a) Introduction to Semiconductor Physics and Diode basics. (b) Diode circuit model, applications and LEDs (c) Introduction to BJTs and basic models (d) BJT amplifier circuit (only focus on common-emitter) (e) Introduction to Op Amps, op-amp ideal and practical models (f) Opamp inverting and non-inverting applications (g) Introduction to FETs, FET analogue applications (h) Simple H-bridge circuits (i) Difference between analogue and digital applications, intro into digital electronics (j) Digital electronic continued (Boolean algebra, logic gates) (k) FET digital applications, introduction to Flip Flops (l) Basics of state machines and electronic instruments.
Lecture times: Mon, Tues 5th period
DP requirements: DP requirements: 80% tutorial attendance, 100% lab attendance
Assessment: Coursework (40%), Exam (60%)

EEE2044S INTRODUCTION TO POWER ENGINEERING

16 NQF credits at HEQSF level 6
Convener: Professor P Barendse
Course entry requirements: MAM1020F/S, PHY1013F/S and EEE1007S

Course outline:
This course aims to help students understand the basic concepts of (a) three-phase AC power generation, voltage, current and power calculations, concepts of balanced and unbalanced systems, measurement of active power by two-wattmeter method, (b) definitions and principles of simple and composite magnetic circuits, magnetic hysteresis, (c) basic principles of operation of electric machines, transformer material; (d) basic principles of operation, construction, operating characteristics, modelling and performance analysis of DC generators, DC motors and BLDC motors, (e) single phase transformers. The course will prepare students to apply engineering and scientific knowledge in carrying out analysis, problem solving and design projects.
Lecture times: Mon, Tues, Wed, Fri, 3rd period
DP requirements: 100% Lab attendance
Assessment: Labs (2%), Project (8%), Tests (30%), Exam (60%)

EEE2045F ANALOGUE ELECTRONICS
16 NQF credits at HEQSF level 6
Convener: Dr J Mwangama
Course entry requirements: EEE1006F
Course outline:
This course aims to give students a sound background in analog electronics design which will help them to understand, analyse and design circuits involving analog electronic components and parts. Topics include: Diodes: Basic Diode Concepts. Load-Line Analysis of Diode Circuits. Zener-Diode Voltage-Regulator Circuits. Ideal-Diode Model. Piecewise-Linear Diode Models. Rectifier Circuits. Wave-Shaping Circuits. Linear Small-Signal Equivalent Circuits Bipolar Junction Transistors: Current and Voltage Relationships (Ebers-Moll model). Common-Emitter Characteristics. Load- Line Analysis of a Common-Emitter Amplifier. pnp-Bipolar Junction Transistors. Large-Signal DC Circuit Models. Large-Signal DC Analysis of BJT Circuits. Small-Signal Equivalent Circuits. Common-Emitter Amplifiers. Emitter Followers Field-Effect Transistors: NMOS and PMOS Transistors. Load-Line Analysis of a Simple NMOS Amplifier. Bias Circuits. Small-Signal Equivalent Circuits. Common-Source Amplifiers. Source Followers. CMOS Logic Gates Amplifiers: Specifications and External Characteristics Basic Amplifier Concepts. Cascaded Amplifiers. Power Supplies and Efficiency.Operational Amplifiers: Ideal Operational Amplifiers. Inverting Amplifiers. Non-inverting Amplifiers. Design of Simple Amplifiers. Op-Amp Imperfections in the Linear Range of Operation. Nonlinear Limitations. DC Imperfections. Differential and Instrumentation Amplifiers. Integrators and Differentiators. Wheatstone Bridge.Frequency Response & Active Filters RLC Circuits and their steady state analysis. Frequency response of single pole RLC circuits. Ideal filter frequency characteristics. Butterworth filter design. Filter design using OpAmps.
Lecture times: Mon, Tues, Thurs, 3rd period
DP requirements: Must finish all the lab modules.
Assessment: Assignments / Tests (20%), Lab (15%), Assignments (5%), Exam (60%)

EEE2046F EMBEDDED SYSTEMS I
16 NQF credits at HEQSF level 6
Convener: Ms RA Verrinder
Course entry requirements: (EEE1006F or EEE2042S) and (CSC1015F or CSC1017F)
Course outline:
This course aims to give students a strong foundation in embedded systems by introducing them to digital system fundamentals, including: information representation, Boolean algebra, logic gate behaviour, combinational and sequential digital circuits, digital building blocks and algorithmic state machines; C programming with a focus on microcontroller applications; basic microcontroller usage, including an introduction to computer architecture, general purpose input/outputs, analogue to digital convertors and basic timers.
Lecture times: Mon, Tues, Wed, Thurs, 4th period
DP requirements: 100% practical attendance and submission

Assessment: Practicals (15%), Tests (25%), Exam (60%)

EEE2047S SIGNALS AND SYSTEMS I
16 NQF credits at HEQSF level 6
Convener: Associate Professor F Nicolls
Course entry requirements: MAM1021S
Course outline:
This course provides students with the basic tools required for understanding linear systems, and the effect that such systems have on deterministic signals. Upon completion, students will be able to characterise and manipulate linear time-invariant systems in terms of input-output relationships, using both time and frequency domain methods. The course includes concepts related to signal representation, linear convolution, Fourier analysis, sampling of continuous-time signals, and Laplace transforms.
Lecture times: Mon, Tues, Wed, Thurs, 4th period
DP requirements: 100% practical and tutorial submission
Assessment: Homework (10%), Labs (10%), Tests (20%), Exam (60%)

EEE2048F PROFESSIONAL COMMUNICATION FOR ELECTRICAL ENGINEERING
8 NQF credits at HEQSF level 6
Convener: Associate Professor J English
Course entry requirements: None
Course outline:
This course aims to develop an understanding of effective reporting. Students learn the requirements for written reports and correspondence in terms of planning, organisation and selection of information. In addition, the students are taught to operate as professionals and to manage social media and exposure.
Lecture times: Mon, Wed, 2nd period
DP requirements: 80% attendance at all lectures and tutorials. Achieve a minimum average of 50% for the combined marks of all the class exercises and mid-course test.
Assessment: Classwork comprising exercises, assignments and a mid course test carries 75% weighting of final mark. Written examination carries 25% weighting of final mark

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EEE2049W INTRO TO ELECTRICAL AND ELECTRONIC ENGINEERING: SCIENCE STUDENTS
24 NQF credits at HEQSF level 6
Convener: Associate Professor S Chowdhury
Course entry requirements: PHY1013F/S, MAM1021F/S
Course outline:
This course aims to prepare Science students majoring in Computer Engineering to apply engineering and scientific knowledge in carrying out analysis, problem solving and design projects. The Electrical Engineering component will cover DC Networks; (b) Fundamentals of AC; (c) Single Phase AC Circuit; (d) Magnetic Circuits; (e) Single-phase Transformers. The students will acquire an understanding of DC circuits and networks, step and sinusoidal excitation of inductive and capacitive circuits, fundamentals of AC quantities and waveforms, phasor diagrams, behaviours of AC through resistance, inductance and capacitance, single phase series and parallel AC circuits, complex power and power factor, magnetic circuits and single phase transformers. The Electronic Engineering component of the course will cover (a) Basic semiconductor physics; (b) rectifier diodes. The students will acquire an appreciation of how diodes are useful and widespread in electronic circuitry such as power supplies; (c) Bipolar Junction Transistors and how these are used in switching and amplifications applications. (d) FETs will similarly be studied and students will learn of their prevelance in modern electronics. The basics of digital electronics such as logic gates

boolean logic will be developed. The basics of CMOS logic operations using transistors is also included.
Lecture times: Mon, Wed, Fri 5th period (1st Semester), Mon, Tues 5th period (2nd Semester)
DP requirements: 1st semester: 100% Laboratory attendance, 80% tutorial attendance, 50% mark for laboratories. 2nd semester: 80% tutorial attendance, 100% lab attendance
Assessment: 1st semester – Lab 10%, Class Test, 30% June Exam 60%. 2nd semester – Coursework, 40% , November Exam 60%

EEE2050F EMBEDDED SYSTEMS I FOR SCIENCE STUDENTS
18 NQF credits at HEQSF level 6
Convener: Ms RA Verrinder
Course entry requirements: EEE2042S, CSC1015F
Course outline:
This course aims to give Science students majoring in Computer Engineering a strong foundation in embedded systems by introducing them to digital system fundamentals, including: information representation, Boolean algebra, logic gate behaviour, combinational and sequential digital circuits, digital building blocks and algorithmic state machines; C programming with a focus on microcontroller applications; basic microcontroller usage, including an introduction to computer architecture, general purpose input/outputs, analogue to digital convertors and basic timers.
Lecture times: Mon, Tues, Wed, Thurs, 4th period
DP requirements: 100% practical attendance and submission
Assessment: Practicals (15%), Tests (20%), Assignment (5%), Exam (60%)

EEE2051L PRACTICAL ELECTRONICS: COMPONENTS, MODULES AND DESIGN
8 NQF credits at HEQSF level 6
Convener: Mr J Pead
Course entry requirements:
Course outline:
This elective course aims to augment theory with supplementary practical materials and technologies. Fundamental material is re-presented in a practical way, to reinforce the foundation in electronic components like passive devices, diodes, BJT and MOSFET transistors, operational amplifiers, CMOS discrete combinational and sequential logic, and microcontrollers. The course also aims to enable students to do fundamental design work, be familiar with how to read and interpret data sheets and how to think laterally, in order to come up with solutions to a design problem.
Lecture times: Winter term
DP requirements: None
Assessment: Practical Assessment (50%), Examination (50%)

EEE3000X PRACTICAL TRAINING
0 NQF credits at HEQSF level 7
Convener: Mr D de Maar
Course outline:
This second opportunity for the student engineer to consolidate through practical experience, culminates in a technical report and certificate showing to the satisfaction of the head of department, evidence of completion of suitable work for a minimum period of six weeks in engineering employment at the end of the third year. The report and certificate is to be submitted by the end of the fourth week of the term immediately following the period of employment. Students who submit evidence of having obtained suitable practical experience prior to their registration may be exempted from EEE3000X. The employer must certify that the student completed the work.
DP requirements: Not applicable.
Assessment: Report

EEE3044S ENERGY CONVERSION & UTILISATION

For Electro-Mechanical and Mechanical Engineering students only.
8 NQF credits at HEQSF level 7
Convener: Mrs K Awodele
Course entry requirements: EEE2031S or EEE2026S or EEE2041F
Course outline:
This course builds on the understanding of AC power theory; three-phase systems, electrical loads and tariffs; DC machines; AC machines, heating and lighting.
Lecture times: Mon, Wed, 4th period, **Tutorial**: Thurs 4th period.
DP requirements: 100% Laboratory attendance and submission and 50% mark for laboratories
Assessment: Laboratory & Assignments (12%), Class Tests (28%), November Examination (60%).

EEE3061W MECHATRONICS DESIGN I

For Electro-Mechanical Engineering students only.
12 NQF credits at HEQSF level 7
Convener: Dr A Patel
Course entry requirements: EEE2041F, EEE2042S
Course outline:
This course aims to develop an advanced understanding of mechatronic design. Topics include: top-down and bottom-up design strategies; applications of electromechanical systems, sensors, power electronics, and actuators to mechatronic design. Computing platforms: embedded micro-controllers and programmable logic controllers (PLCs), and case histories in mechatronic design are also covered.
Lecture times: Semester 1: Tues meridian. Semester 2: TBA
DP requirements: Completion of projects
Assessment: Projects (70%), Class Test (30%)

EEE3088F ELECTRICAL ENGINEERING DESIGN PRINCIPLES

8 NQF credits at HEQSF level 7
Convener: Dr A Patel
Course entry requirements: EEE2045F , EEE2047S
Course outline:
This course aims to equip students with the skills required to undertake engineering design and synthesis at sub-system level. Design methodology and various approaches to procedural design are introduced. Exposure to various simulation tools is provided to ensure that students are able to evaluate first phase designs systematically. Modelling and measurement error analysis are introduced and statistical modelling of engineering designs is emphasized. Optimization using both gradient and soft computing methods is introduced as an invaluable tool in modern, multi-constraint based design and synthesis. The course will include assignments developing from component level to sub-system level problems. These assignments will focus on the skills required for practical engineering design.
Lecture times: Mon 6th, 7th period
DP requirements: Submission of all assignments
Assessment: Assignments (50%); Exam (50%)

EEE3089F ELECTROMAGNETIC ENGINEERING

16 NQF credits at HEQSF level 7
Convener: Dr W F Schonken
Course entry requirements: PHY2010S, MAM2083F/S
Course outline:
This course aims to introduce 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. Simplication to very short lines such as power lines are discussed. A selection of conventional and modern waveguide structures are considered. Finally, an overview of computational methods for the solution of realistic electromagnetic problems are presented.
Lecture times: Mon, Tue, Wed, Thu 4th period, compulsory interactive sessions Friday 7th and 8th periods
DP requirements: Interactive session participation and submission of all assignments**.**
Assessment: Practical Assignment (20%); Tutorial Tests (30%); Exam (50%)

EEE3090F ELECTRONIC DEVICES & CIRCUITS
16 NQF credits at HEQSF level 7
Convener: Dr MY Abdul Gaffar
Course entry requirements: EEE2045F, EEE2047S
Course outline:
Recap of fundamental concepts – resistors, capacitors, inductors, diodes, bipolar transistors, op- amps, filters Active Filters – Second order and higher order filters, standard filter responses, design of low-pass, high-pass and band-pass filters, transfer function of Sallen and Key.Op-amps – Building blocks of internal circuitry, parameters and non-ideal effects, impact of DC non-ideal effects and compensation, effect of negative feedback on input impedance, output impedance and bandwidth of op-amps, identifying circuit parameters for various applications.Practical circuits – Difference and instrumentation amplifiers, practical integrators, practical differentiators.Voltage Regulation - line & load regulation.Linear Voltage Regulators – series regulators, standard circuits, overcurrent protection, overvoltage protection, selection of pass transistor elements, standard integrated circuits.Oscillators - Barkhausen criteria, Phase-shift oscillators, Wein-bridge oscillators, Relaxation oscillators, Hartley, Colpitts & Pierce oscillators.Current Sources - BJT and FET based, Basic two-transistor, Three-transistor, Cascode, Wilson and Widlar configurations. Differential Amplifiers - Basic BJT differential pair, DC analysis, AC analysis, Common Mode Rejection Ratio, FET implementations. Linear Power Amplifiers - Class, A, B, AB, efficiency, power output constraints, heatsink design.Switched Mode Power Supplies - buck, boost, inverting, switched capacitor, gate driver circuits.Noise – Amplifier noise, noise measurements and noise sources. SPICE based simulations.
Lecture times: Mon, Tue, Wed, Thu 3rd period
DP requirements: Completion of all laboratory experiments and tutorials
Assessment: 2 Class tests: (30%); 3 hour exam: (50%); Tutorials: (16%); Practicals: (4%)

EEE3091F ENERGY CONVERSION
16 NQF credits at HEQSF level 7
Convener: Professor MA Khan
Course entry requirements: EEE2044S
Course outline:
This course aims to introduce students to the fundamentals of AC Electrical Machines and Power Electronics. Several machine types are studied, which include: induction, synchronous and other modern AC machines. The features, characteristics and performance of each machine type are studied. Uncontrolled and controlled rectifier circuits are introduced and analysed in detail. DC-DC converters are also be introduced. Topical industrial applications of AC machines and Power Electronics are also discussed.
Lecture times: Mon, Tue, Wed, Thu 2nd period
DP requirements: 100% Laboratory attendance and 50% mark for laboratories and submission of project
Assessment: Project: 5%; Tests: 35%; Exam: 60%

EEE3092F SIGNALS & SYSTEMS II
16 NQF credits at HEQSF level 7
Convener: Associate Professor AJ Wilkinson
Course entry requirements: EEE2047S, MAM2083F/S
Course outline:
This course aims to develop the understanding of: 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. Additionally this course aims to develop the understanding of: 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.
Lecture times: Mon, Tue, Wed, Thu 5th period
DP requirements: Attendance at tutorials, attendance at 80% of lectures, completion and submission of all assignments, laboratory work and class tests.
Assessment: Tuts 5%,; Labs 10%,; Tests 20%,; Exam 65%

EEE3093S COMMUNICATION AND NETWORK ENGINEERING
16 NQF credits at HEQSF level 7
Convener: Dr J Mwangama
Course entry requirements: EEE2046F
Course outline:
This course aims to develop the understanding of Computer Networks and the Internet: Internet, network edge, network core, network performance metrics, protocol layers and service models, LAN topology, Physical media, OSI reference model and TCP/IP reference model, network standardization, computer network attacks and prevention, history of computer networking and the Internet. Application and Transport Layers: Principle of network applications, socket programming, transport layer services, multiplexing/demultiplexing, connectionless transport, connection-oriented transport (TCP), TCP congestion control and performance issues. Network Layer: Network layer design issues, forwarding and routing, virtual circuit and datagram networks, router architecture, Internet protocol, routing algorithms, routing in the Internet, integrated and differentiated services. Data Link Layer: Data link design issues, error detection and correction, multiple access links and protocols, switched local area networks, IEEE 802 family, link virtualization, MPLS, data centre networking. Physical Layer: Baseband systems, formatting textual data, formatting analogue information, sources of corruption, pulse code modulation, quantization, baseband modulation and demodulation/detection, inter-symbol interference, equalization, bandpass modulation and demodulation/detection amplitude. Emerging Communication Networks: Fundamentals of mobile networks, fundamentals of smart grid communication networks.
Lecture times: Mon, Tue, Wed, Thu 3rd period
DP requirements: 100% completion of laboratory assignments and tutorials; minimum of 50% for laboratory assignments
Assessment: Tutorials & Laboratories (15%); Class Tests (25 %); Examination (60%)

EEE3094S CONTROL SYSTEMS ENGINEERING
16 NQF credits at HEQSF level 7
Convener: Dr MS Tsoeu
Course entry requirements: EEE2047S, MAM2084F, EEE2045F

Course outline:
This course aims to develop the understanding of open and closed loop configurations, block diagrams, dynamic system modelling, transient response, steady state error criterion. System stability: Routh Hurwitz criterion, Root Locus. Frequency responses. Nyquist plots, 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.
Lecture times: Mon, Tue, Wed, Thu 4th period
DP requirements: 100% Laboratory attendance, completion of all assigned class work
Assessment: 60% November Exam; 20% project; 10% Class Test(s); 10% Assignments/Tutorial Tests

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EEE3095S EMBEDDED SYSTEMS II FOR SCIENCE STUDENTS
18 NQF credits at HEQSF level 7
Convener: Dr Y Abdul Gaffar
Course entry requirements: EEE2050F
Course outline:
This course focuses on embedded systems and computer architecture, covering the theory and practices for the design and analysis of embedded systems, embedded operating systems, modelling and simulation of embedded systems, and an introduction to Hardware Description Language (HDL) programming. This course builds on the Embedded Systems I course. The course is split into two parts. Part 1 (10 credits) concerns the design process, modelling and analysis of embedded systems designs, the structure of an operating systems, cross-compiling toolchains, and relevant related theories. Techniques for execution time analysis, resource control protocols, and methods for modelling and simulation of computer systems are studied. Practicals concern using and embedded operating system, building applications using a cross-compiler, hardware/software interfacing, and using a single board computer embedded platform. Part 2 (6 credits) introduces HDL programming and techniques and tools for developing gateware and simulating HDL designs. A miniproject (Project A) is performed which involves implementing a state machine and performing thorough analysis of its design and performance. A more significant computer system design project (Project B), that counts 2 credits, is to be completed by computer science students.
Lecture times: Mon, Tue, Wed, Thu 5th period
DP requirements: Completion of all practical assignments as well as both projects. Minimum 50% for the weighted sum of practicals and project marks.
Assessment: Practicals (14%); ProjectA (10%); ProjectB (11%); Tests (15%); Exam (50%)

EEE3096S EMBEDDED SYSTEMS II
16 NQF credits at HEQSF level 7
Convener: Dr Y Abdul Gaffar
Course entry requirements: EEE2046F
Course outline:
This course focuses on embedded systems and computer architecture, covering embedded operating systems, theory and practices for the design and analysis of computer architecture and an introduction to Hardware Description Language (HDL) programming. This course builds on Embedded Systems I course. The course is split into two parts. Part 1 (10 credits) concerns the design process, modelling and analysis of embedded systems designs, the structure of an operating systems, cross-compiling toolchains, and relevant related theories. Techniques for execution time analysis, resource control protocols, and methods for modelling and simulation of computer systems are studied. Practicals concern using and embedded operating system, cross-compiling applications, and using a single board computer embedded platform. Part 2 (6 credits) introduces HDL programming and techniques and tools for developing gateware and simulating designs. A mini- project is performed which involves implementing a state machine and performing thorough analysis of its design and performance.

Lecture times: Mon, Tue, Wed, Thu 5th period
DP requirements: Completion of all practical assignments and project. Minimum 50% for the weighted sum of practicals and project marks.
Assessment: Practicals (20%); Project (10%); Tests (20%); Exam (50%)

EEE3097S ENGINEERING DESIGN: ELECTRICAL AND COMPUTER ENGINEERING
8 NQF credits at HEQSF level 7
Convener: Associate Professor AJ Wilkinson
Course entry requirements: EEE2045F, EEE2047S. EEE3088F
Course outline:
In this course students will be assigned a design problem relevant to the Electrical & Computer 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 it methodically using the skills they have gathered over the previous semesters of the curriculum, especially from the Design Principles course.
Lecture times: No lectures, project work only
DP requirements: 80% participation in all components of the course
Assessment: Continuous assessment: this will be assessed based on two to three well-defined deliverables over the semester) (50%); Demonstration and report on the design process and choices (50%).

EEE3098S ENGINEERING DESIGN: ELECTRICAL ENGINEERING
8 NQF credits at HEQSF level 7
Convener: Dr D Oyedokun
Course entry requirements: EEE2045F, EEE2047S. EEE3088F
Course outline:
In this course 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 a problem methodically using the skills they have gathered over the previous semesters of the curriculum, especially from the Design Principles course.
Lecture times: Ad-hoc lectures, project work.
DP requirements: 80% participation in all components of the course
Assessment: Continuous assessment: this will be assessed based on two to three well-defined deliverables over the semester) (50%); Demonstration and report on the design process and choices (50%).

EEE3099S ENGINEERING DESIGN: MECHATRONICS
8 NQF credits at HEQSF level 7
Convener: Dr A Patel
Course entry requirements: EEE2045F, EEE2047S. EEE3088F
Course outline:
In this course students will be assigned a design problem relevant to the Mechatronics 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 a problem methodically using the skills they have gathered over the previous semesters of the curriculum, especially from the Design Principles course.
Lecture times: No lectures, project work only
DP requirements: 80% participation in all components of the course
Assessment: Continuous assessment: this will be assessed based on two to three well-defined deliverables over the semester) (50%); Demonstration and report on the design process and choices (50%).

EEE3100S POWER SYSTEMS ENGINEERING

16 NQF credits at HEQSF level 7

Convener: Professor KA Folly

Course entry requirements: EEE2044S

Course outline:

This course aims to develop further skills and knowledge in power systems engineering, power systems network models, per-unit, load flow and balanced fault calculations, transformers, protection principles, electrical loads and tariffs and electricity market

Lecture times: Mon, Tue, Wed, Thu 5th period

DP requirements: 100% completion of laboratory assignments and tutorials. Obtain 50% mark for laboratories, 100% attendance of site visits, pass ECSA ELO 5 evaluations.

Assessment: Practicals (6 %); Assignment /Site visit (6 %); Tests (28%); Exam (60%)

EEE4006C PROFESSIONAL COMMUNICATION STUDIES

8 NQF credits at HEQSF level 8

Convener: Associate Professor J English

Course entry requirements: EEE3073S orEEE2048F

Co-requisites: EEE4051C

Course outline:

This advanced course in professional communication aims to develop an understanding of: professional writing including business proposals, graphic communication, CVs, posters, readability, and group presentations using PowerPoint, to an audience drawn from industry.

Lecture times: Tues 4th & 5th period

DP requirements: (1) 80% attendance (2) 100% hand-in of assignment (3) Satisfactory demonstration of required components of ELO 6 and 10

Assessment: Tutorials & Group Work (6%), Projects (50%), Class Test (4%), Presentation Examination (40%).

EEE4022S RESEARCH PROJECT

This course is also available in the first semester as EEE4022F

40 NQF credits at HEQSF level 8

Convener: Dr R Smit

Course entry requirements: All 1st, 2nd, 3rd year core courses and specific, individual, requirements depending on the topic selected. A maximum of 32 credits of coursework can be taken at the same time as the final year project.

Course outline:

The final year research project is an important opportunity, at the end of the degree programme, to tackle a real engineering project that involves the creative application of scientific principles to the solution of problems in society. The student is expected to work on the project both individually and under the guidance of a supervisor. The project involves: a problem description or research hypothesis developed in consultation with a supervisor; reviewing the topic in detail and defining the boundaries (scope) carefully, to confirm an understanding of the requirements of the project; searching for, and critically engaging the relevant literature, selecting and justifying the most appropriate approaches to solving the problem or testing the hypothesis; analysis, simulation, designing, building, integrating and testing as appropriate, hardware and software; evaluating the project against the success criteria and design objectives; writing a report about the project, the findings, and any recommendations. An oral presentation and the preparation of an exhibit of the project is also required.

DP requirements: Meetings with supervisor to discuss progress towards satisfying all the Exit Level Outcomes. Oral presentation and Open Day exhibition of project. Timeous hand-in of final project.

Assessment: Oral (10%), Project Report (90%)

EEE4051C NEW VENTURE PLANNING
8 NQF credits at HEQSF level 8
Convener: TBC
Course entry requirements: EEE2038W, EE2039W or equivalent, EEE3073S, MAM2084S
Co-requisites: EEE4006C
Course outline:
This advanced course in new venture planning aims to develop an understanding of: the entrepreneurial perspective; developing a new venture; feasibility studies; product concept and description; market assessment; industrial analysis; regulatory aspects; marketing plans; operations, development plans and management; staffing and labour issues; financial projections; and intellectual property.
Lecture times: Tues 6th period; Wed 7th period
DP requirements: Satisfactory demonstration of required components of Exit Level Outcome 11.
Assessment: Test (10%), Business Plan (60%), Two-hour exam (30%).

EEE4086F MICROWAVE ENGINEERING
16 NQF credits at HEQSF level 8
Convener: TBC
Course entry requirements: Students with the Computer and Electrical Engineering and Electrical Engineering Programmes and with a pass result for EEE3089F.
Course outline:
This course focuses on aspects related to systems operating at RF (radio frequency), microwave and millimetre wave frequencies, such as communication systems, radar systems and radio-astronomy receivers. It includes antennas and antenna array theory, propagation in space and urban environments and the variations at different frequencies, high frequency measurement techniques and accuracy of measurements, origin of non-linearity in systems and a functional overview of typical components used in these systems. A selection of Radar, Radio Astronomy and Communications system architecture are studied in detail. System design principles and practical computational EM (electro-magnetic) modelling are an integrated part of the course.
Lecture times: Tue, Thu 7th and 8th period, practical/visualization Fridays 3rd and 4th period.
DP requirements: 100% completion of laboratory sessions and tutorials; minimum mark of 50% for the assignment.
Assessment: Design task (20%); Two tests (30%); Exam (50%).

EEE4113F ENGINEERING SYSTEM DESIGN
16 NQF credits at HEQSF level 8
Convener: Associate Professor AK Mishra
Course entry requirements: In the 4th academic year of study (AYOS4)
Course outline:
This course aims to consolidate prior material in the context of professional project and design work. Students working individually as well as in groups will tackle a design assignment, leading to submission of a technical report. Topics include: Various models for the stages of formal design methodologies, divergent and convergent thinking, South African industrial design case studies, context analysis (STEEPLE), idea generation, creative methods to organise thinking and planning, user requirements and specifications, project clarification and scope, design standards and codes, systems engineering approach, detail aspects and checklists related to concept, embodiment and final designs, redundancy in systems, worst-case design, sensitivity analysis and cost and project life-time estimation as well as design-thinking applied to final-year projects.
Lecture times: Mon, Tue, 3rd, 4th, 5th period
DP requirements: Pass ELO's 3 and 8 (team work)
Assessment: Design Project 50%, Final Examination 50%

EEE4114F DIGITAL SIGNAL PROCESSING
16 NQF credits at HEQSF level 8
Convener: Associate Professor F Nicolls
Course entry requirements: EEE3086F or EEE3069W; EEE3092F or EEE3094S; or equivalent
Course outline:
This course aims to develop an advanced understanding of digital signal processing. Topics include: discrete time signals and systems; the discrete fourier transform properties and fast algorithms; the z-transform; frequency response from z-plane; FIR and IIR filter design and structures for digital filters. The course includes a specialist component in an applied or advanced signal processing application area.
Lecture times: Mon, Wed, 6th, 7th period
DP requirements: None
Assessment: Project and assignments (20%), class test (20%), June examination (60%)

EEE4115F POWER DISTRIBUTION AND TRANSMISSION NETWORKS
16 NQF credits at HEQSF level 8
Convener: Mrs K Awodele
Course entry requirements: EEE3091F, EEE3100S
Course outline:
This course aims to develop an advanced understanding of power distribution and transmission networks. Topics include: transmission and distribution, electrical loads and load forecasting, overhead lines and cables, substations, renewable energy generation, distributed generation, smart grids, power system protection, high voltage engineering, and power system reliability and power quality, electrification, delivery process and pricing.
Lecture times: Mon, Tues, 2nd, 3rd period
DP requirements: 1) 100% Lab Attendance and submission, 2) At least 50% marks for labs, 3) Pass ECSA ELO evaluation, 4) 100% attendance of site visits.
Assessment: Lab Assignments (10%), Project and Site visits (10%), Class Tests (20%), June Exam (60%)

EEE4116F POWER SYSTEMS ANALYSIS, OPERATION & CONTROL
16 NQF credits at HEQSF level 8
Convener: Professor KA Folly
Course entry requirements: EEE3091F, EEE3100S
Course outline:
This course aims to develop an advanced understanding of various topics in the analysis, operation and control of electric power systems, and their practical applications. Topics include: Graph theory, admittance and impedance matrices, power flow studies, symmetrical components, fault calculation, power system security states, optimisation of power system operations, power system stability and control, dynamic security analysis, grid operations, control centres, HVDC systems and geomagnetic induced currents(GIC)
Lecture times: Wed, Thurs, 2nd, 3rd period
DP requirements: 1) 100% Lab attendance and submission, 2) At least 50% marks for labs
Assessment: Labs, projects and assignments (20%), Class Tests (20%), June Exam (60%)

EEE4117F ELECTRICAL MACHINES AND POWER ELECTRONICS
16 NQF credits at HEQSF level 8
Convener: Professor MA Khan
Course entry requirements: EEE3091F or equivalent
Course outline:
This course aims to develop an advanced understanding of speed control of electrical machines and power electronic circuits. In particular, the analytical models of DC and AC machines are

manipulated to achieve speed control of these machines. Furthermore, circuit topologies, switching patterns and waveforms of DC-DC converters and DC-AC inverters are studied.
Lecture times: Mon; Tues, 4th & 5th period
DP requirements: 100% Lab attendance and 50% mark for labs and submissions of project/s
Assessment: Project/s (10%), Class Tests (30%), June Exam (60%)

EEE4118F PROCESS CONTROL AND INSTRUMENTATION
16 NQF credits at HEQSF level 8
Convener: Dr M Tsoeu
Course entry requirements: EEE3094S
Course outline:
This course aims to present a unified and holistic view of industrial control, automation and instrumentation. It covers topics on industrial automation, measurements and instrumentation, and introduces advanced control methods. Specific topics are: the industrial automation hierarchy; automation drawings – P&ID diagrams; Programmable Logic Controllers; Supervisory Control and Data Acquisition; Distributed Control Systems; Sensing and Measurement Techniques; Batch Processes; Automation Networks; Safety Systems; and a selection of Advanced Control topics such as Nonlinear, Quantitative Feedback Theory, H-infinity and Model Predictive Control. The course aims to develop knowledge, skills and values through a balanced integration of lecturers, tutorials, laboratory and project work.
Lecture times: Wed, Thurs, 4th, 5th period
DP requirements: 100% attendance of labs, completion of all assigned class work, pass all ECSA Exit Level Outcomes assigned to the course.
Assessment: Class Tests and Assignments (20%), Class Project (20%), June Exam (60%)

EEE4119F MECHATRONICS II
16 NQF credits at HEQSF level 8
Convener: Dr A Patel
Course entry requirements: MEC2047F, MEC2045S
Course outline:
The course aims to provide a unified and holistic view of automation of mechanical systems. Specific topics are: Multibody Kinematics (2D&3D), Inverse Kinematics, Euler-Lagrange Mechanics, Numerical Simulation, Friction modelling and a selection of nonlinear control topics from: Feedback Linearisation, Lyapunov Stability, Sliding Control, Gain Scheduling, Manipulator control and Trajectory Optimisation. Applications of techniques will be tailored towards terrestrial, sea, air as well as industrial robotic systems. The course aims to develop knowledge, skills and values through a balanced integration of lectures, tutorials, laboratory and project work.
Lecture times: Mon, Tues, 2nd, 3rd period
DP requirements: 1) 100% completion of labs, 2) Completion of all assigned class work, 3) Pass all ECSA Exit Level Outcomes assigned to the course
Assessment: Class tests and assignments (20%), Class project (20%), June Exam (60%)

EEE4120F HIGH PERFORMANCE DIGITAL EMBEDDED SYSTEMS
16 NQF credits at HEQSF level 8
Convener: Dr S Winberg
Course entry requirements: EEE3096S
Course outline:
This course aims to consolidate an understanding of Parallel computing, with a focus on design for parallel systems. This includes theory of parallel algorithm development, developing golden measures, performance analysis, benchmarking essentials, implementating parallel code. Topics include fundamental theories, design practices, and techniques related to the design of digital high performance embedded systems. The lectures include a number of case studies related to real systems that were developed. Additionally the course aims to consolidate an understanding of

Reconfigurable computing and the design and development of hardware description language (HDL) code for use with Field Programmable Gate Arrays (FPGAs) platforms. The latter part of the course has an emphasis on the use of FPGAs and HDL programming in relation to design and application development for ReConfigurable (RC) hardware platforms.
Lecture times: Tues, Thurs, 6th, 7th period
DP requirements: Minimum 40% overall class average to write the final exam
Assessment: Labs (10%), Project (10%), Tests (20%), June Exam (50%)

EEE4121F MOBILE AND WIRELESS NETWORKS
16 NQF credits at HEQSF level 8
Convener: Associate Professor O Falowo
Course entry requirements: EEE3093S
Course outline:
This course aims to develop an understanding of mobile and fixed networks. Topics include: Wireless Network Fundamentals, Wireless and Wireline Access Technologies, Radio Resource Management, Mobility Management, Traffic and Congestion Control, QOS in Packet Network, IP Traffic Engineering, Network Convergence, Network Services and Applications Requirements, Data Plane and Control Plane Technologies, and Performance modeling and simulation.
Lecture times: Mon, Tues, 4th, 5th period
DP requirements: 1) 100% Tutorial submission and lab attendance, 2) Pass ELO evaluation in the project, 3) A minimum of 50% lab mark.
Assessment: Lab, Project and Tutorial (20%), Class Test (20%), June Exam (60%).

EEE4122C COMMUNICATION ENGINEERING
8 NQF credits at HEQSF level 8
Convener: Dr A Murgu
Course entry requirements: EEE3093S
Course outline:
This course aims to develop an understanding of communication engineering. Topics include: Elements of information theory, error-control coding, source coding and baseband signalling, bandpass modulation and demodulation/detection, synchronisation, resource allocation, communication link analysis, and a system design example.
Lecture times: Mon, Tues, Wed, 5th period, **Tutorial**: Thurs, 5th period
DP requirements: 1) 100% Tutorial submission and lab attendance, 2) A minimum of 50% lab mark
Assessment: Lab and Tutorial (20%), Class Test (20%), Exam (60%)

EEE4123C ELECTRICAL MACHINES AND DRIVES
8 NQF credits at HEQSF level 8
Convener: Professor P Barendse
Course entry requirements: EEE3091F
Course outline:
This course provides an introduction to reference frame theory; dq-machine modelling; field orientated control of a permanent magnet synchronous motor and induction motor; and an introduction to single-phase induction motors.
Lecture times: Mon, Tues, Wed, Fri, 2nd period
DP requirements: None.
Assessment: Projects (10%), Class Tests (25%), Tutorials (5%), Exam (60%)