Bachelor of Science in Engineering in Mechatronics
BSc(Engineering)(Mechatronics)[EB011EEE05]

Associate Professor and Programme Convener:
F Nicolls, MSc(Eng) PhD *Cape Town*

Mechatronics is an interdisciplinary branch of engineering which combines a fundamental background in mechanical engineering with light-current electrical engineering. Many universities and other institutions world-wide are now offering courses or degrees in Mechatronics, and it is increasingly recognised that this combination of mechanical and electrical engineering studies equips graduates with an excellent basis upon which to build valuable engineering roles in modern industry.
Apart from receiving a thorough grounding in both electrical and mechanical engineering, the Mechatronics student at UCT will gain a foundation in physical science, advanced engineering mathematics, electro-mechanical control theory, microcomputer technology, systematic engineering design and some principles of engineering management. In addition, the Mechatronics Programme offers final-year optional courses in related fields, such as bio-medical engineering and industrial management.

The Mechatronics engineer in industry may require expertise across a broad range of engineering disciplines, and will be especially well-suited to a career in light manufacturing or process control. Mechatronics engineers may become involved in fields such as instrumentation, automation, robotics, bio-medical engineering or machine vision. The Mechatronics Programme at UCT aims to equip its graduates with a solid and broad-based engineering education, including the skills in design and the knowledge of computers and other digital systems hardware, that will be necessary for a successful future career in any of these environments. The Mechatronics Programme is administered as a distinct Programme within the Department of Electrical Engineering, and student advice specific to the needs of Mechatronics undergraduates is available to students on the Programme. Some students currently on the Programme enjoy industrial sponsorship, in the form of bursaries.

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 (ME)

Number	Course	NQF Credits	HEQSF Level
AXL1200S	Culture, Identity & Globalization in Africa	8	5
CSC1015F	Computer Science 1015	18	5
CSC1016S	Computer Science 1016	18	5
EEE1006F	Introduction to Electronic Engineering	12	5
EEE1007S	Introduction to Electrical Engineering	12	5
MAM1020F	Mathematics IA for Engineers	18	5
MAM1021S	Mathematics IB for Engineers	18	5
MEC1003F	Engineering Drawing	8	5
PHY1012F	Physics A 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 (ME)

Number	Course	NQF Credits	HEQSF Level
EEE2044S	Introduction to Power Engineering	16	6
EEE2045F	Analogue Electronics	16	6
EEE2046F	Embedded Systems I	16	6
EEE2047S	Signals and Systems I	16	6
EEE2048F	Professional Communication for Electrical Engineering	8	6
MAM2083F	Vector Calculus for Engineers	16	6
MAM2084S	Linear Algebra and DEs for Engineers	16	6
MEC1009F	Introduction to Engineering Mechanics	16	5
MEC2026S	Project Management	8	6
PHY2010S	Electromagnetism for Engineers	16	6
	Total credits per year	**144**	

Third Year Core Courses (ME)

Number	Course	NQF Credits	HEQSF Level
EEE3017W	Digital Electronics	16	7
EEE3031S	Energy Utilisation	10	7
EEE3061W	Mechatronics Design I	12	7
EEE3068F	Electronic Circuits	12	7
EEE3069W	Control Engineering	20	7
EEE3073S	Professional Communication Studies	12	7
MEC2023F	Dynamics 1	16	6
MEC2025F	Mechanics of Solids	12	6
MEC2026S	Project Management	8	6
MEC3031S	Dynamics II	16	7
MEC3035S	Computer Integrated Manufacture & Robotics	8	7
EEE3000X	Practical Training	0	7
	Total credits per year	**142**	

Third Year Optional Courses (ME)

Number	Course	NQF Credits	HEQSF Level
EEE3086F	Signals & Systems II	12	7

Fourth Year Core Courses (ME)

Number	Course	NQF Credits	HEQSF Level
EEE4006F	Professional Communication Studies	8	8
EEE4022S/F	Final Year Project	40	8
EEE4051F	New Venture Planning	8	8
EEE4093F	Process Control & Instrumentation	20	8
EEE4099F	Electrical Machines & Power Electronics	20	8
EEE4113C	Engineering System Design	16	8
MEC4022Z	Industrial Law	8	8
MEC4063C	Industrial Ecology	8	8

Fourth Year Optional Courses (ME)

Choose courses amounting to at least 32 credits from the following:

Number	Course	NQF Credits	HEQSF Level
EEE4001F	Digital Signal Processing	20	8
EEE4086F	Microwave Engineering	16	8
EEE4088F	Communication Engineering	16	8
EEE4104C	Electrical Machines & Drives	10	8

Optional Courses

The following optional courses are possible, timetable permitting, to bring the credit total to at least 576 credits:

Number	Course	NQF Credits	HEQSF Level
AST1000F	Introduction to Astronomy	18	5
AST2002H	Astrophysics	24	6
END1019L	Social Infrastructures: Engaging with community for change	18	5
HUB2005F	Introduction to Medical Engineering	8	6
MEC3023F	Mechanics of Solids	12	7

ELECTRICAL ENGINEERING

The Department offers the following Undergraduate Degree programmes:

Bachelor of Science in Engineering Degree Programme in
Electrical Engineering
Electrical and Computer Engineering
Mechatronics

The Department of Electrical Engineering is located on the 4th floor of the Menzies Building, Library Road, Upper Campus, Rondebosch.

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Staff

Professor and Head of Department:
ES Boje, PrEng BSc(Eng) *Wits* MSc(Eng) PhD *Natal* FSAAE SMSAIMC MIEEE

Professors:
A Baghai-Wadji, MSc(Eng) PhD DSc Vienna FEMA SMIEEE
KA Folly, MSc(Eng) *Beijing* PhD *Hiroshima* MIEEJ SMIEEE
P Martinez, BScHons(Mat Eng) MSc PhD *Cape Town* IAA, IISL, FRAS, MSAIP

Emeritus Professors:
M Braae, MSc(Eng) *Cape Town* PhD *UMIST* MIEEE
BJ Downing, MSc *Bradford* PhD *Sheffield*
G de Jager, MSc *Rhodes* PhD *Manchester* MBL *SA* MIEEE
CT Gaunt, BSc(Eng) *Natal* MBL SA PhD *Cape Town* FIET FSAIEE
MR Inggs, BSc(Hons) Rhodes PhD *London* SMIEEE
A Petroianu, Dipl Ing *USSR* Dr Ing *Bucharest* FIEEE VDE CIGRÉ
P Pillay, CEng BSEng *UDW* MSc(Eng) *Natal* PhD *Virginia Tech* FIET FIEEE
KM Reineck, CEng Dip Eng *Cologne* DipEIEng *Dunelm* PhD *Newcastle* VDE FIET

Honorary Professor:
R Prasad, BScEEng *Sindri* MScEEng PhD *Mesra* PPh

Adjunct Professor:
PJ Cilliers, PrEng BEng (Hons) *Pret* MS *George Washington* PhD *Ohio* SAIP

Associate Professors:
P Barendse, MSc(Eng) PhD *Cape Town* MIEEE
S Chowdhury, BEE(Hons) PhD (Eng) *Kolkata* MIET SMIEEE MIE SMSAIEE
ME Dlodlo, Reg Eng, BSEE BS *Geneva* MSc *Kansas State* PhD *Delft* FZweIE MIEEE
OE Falowo, BEng MEng *Akure* PhD *Cape Town* SMIEEE
RH Geschke, BEng MSc(Eng) PhD *Stellenbosch* SMIEEE
MA Khan, MSc(Eng) PhD *Cape Town* SMIEEE
A Mishra, BE (*REC India*) PhD *Edinburgh* SMIEEE
F Nicolls, MSc(Eng) PhD *Cape Town*
D O'Hagan, BEng (Hons) MSc *Ulster* PhD *UCL*
AJ Wilkinson, BSc(Eng) *Cape Town* PhD *London*

Emeritus Associate Professors:
JR Greene, MSc(Eng) *Cape Town* MIEEE
M Malengret, MSc(Eng), PhD *Cape Town*

Honorary Associate Professor:
R Laufer, Dipl.-Ing *TU Berlin*, Dr.-Ing. *Univ. Stuttgart* IAA

Senior Lecturers:
MY Abdul Gaffar, MSc(Eng) PhD *Cape Town*
SI Ginsberg, MSc(Eng) Cape Town
M Hanif, BEng(Hons) *UK* PhD *Ireland* MIEEE, MIET
A Murgu, MSc(Eng) *Bucharest* Ph Lic (Comp Sci) PhD *Jyväskylä* MIEEE
A Patel, MSc(Eng) PhD *Cape Town* MIEEE
R Smit, MSc(ScEd) *Witwatersrand,* (Academic Development)

Honorary Adjunct Senior Lecturer
Froehlich A, LL.M.MAS Maître en Droit *France*, Dr jur *Vienna*, IISL

Adjunct Senior Lecturer:
I Khan, MSc(Eng) *Cape Town* MIEEE

Lecturers:
K Awodele, Reg Eng, BSc(Eng) *Ife* MSc(Eng) *Abu* PGDM MNSE MIEEE
J Mwangama, MSc(Eng) *Cape Town*, MIEEE
D Oyedokun, MSc(Eng) PhD *Cape Town* MIEEE SAIEE
MS Tsoeu, MSc(Eng) *Cape Town* MIEEE
RA Verrinder, MSc(Eng) *Cape Town* MIEEE
S Winberg, BSc(Hons) *Cape Town* MSc *UTK* PhD *Cape Town*

Senior Scholar:
MJE Ventura, PrEng BSc(Maths, Physics) BSc(Eng) *Cape Town* BSc(Hons) *Pret* MIEEE MSAIEE

Senior Research Officer:
R Herman, BSc(Eng) *Cape Town* MSc(Eng) PhD(Eng) *Stell*

Principal Technical Officer:
AC Wozniak, BSc(Eng) *Cape Town*

Chief Technical Officers:
J Pead, BSc(Eng), MSc(Eng) *Cape Town*
D De Maar, BEd(Hons) *Cape Town*

Senior Technical Officers:
P Bizimana
P Titus

Technical Officer:
B Daniels

Departmental Manager:
J Buxey

Administrative Officer (Undergraduate):
M van der Westhuizen BA PGDip LIS *Cape Town*

Finance Officer:
C Koonin

Administrative Assistant (Postgraduate):
N Moodley

Administrator (General):
R Harris

Receptionist:
L Johannes

The activities of the Department cover a wide field both at undergraduate and postgraduate level. The Department regards laboratory work as of significant importance and a range of dedicated laboratories exist. These are in the fields of Control and Process Control, Data Communications, Digital Systems and Computers, Electrical Machines and Transformers, Electronics and Telecommunications, Image Processing, Instrumentation, Microwave, Radar, Robotics, Power Electronics and Power Systems.

The undergraduate programmes endeavour to provide the student with an education in *Electrical Engineering* with a range of specialisations, in *Electrical and Computer Engineering* and in *Mechatronics.*

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 weeks duration.
DP requirements: Not applicable.

EEE1006F INTRODUCTION TO ELECTRONIC ENGINEERING
12 NQF credits at HEQSF level 5
Convener: Ms R Smit
Course outline:
Lecturer: Mr S Ginsberg
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, 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: Mrs R Smit
Course outline:
Lecturers: Associate Professor S Chowdhury and Ms R Smit
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, 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
For students in the Electro-Mechanical Engineering programme.
12 NQF credits at HEQSF level 6
Convener: Associate Professor S Chowdhury
Course entry requirements: PHY1013S, MAM1021S
Course outline:
Lecturers: Associate Professor S Chowdhury, Dr M Hanif
The course aims to help students understand: (a) DC Networks including DC circuits, series, parallel and star-delta connection of resistances and star-delta transformation, voltage and current sources, Kirchoff's laws, DC Network theorems (Superposition, 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 Transformer 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. The course will prepare students to apply engineering and scientific knowledge in carrying out analysis, problem solving and design projects.
Lecture times: Mon, Wed, Fri, 3rd period
DP requirements: 1) 100% Laboratory attendance and submission. 2) 50% mark for laboratories 3) Satisfactory completion of project
Assessment: Project (5%), Class Test (35%), June Examination (60%).

EEE2042S INTRODUCTION TO ELECTRONIC ENGINEERING
For students in the Electro-Mechanical Engineering programme.
12 NQF credits at HEQSF level 6
Convener: Ms J Mwangama
Course entry requirements: MAM1018F/S, PHY1013F/S, DP for EEE2041F.
Course outline:
The course aims to help students understand the following concepts: (a) Basic semiconductor physics such as charged particles and the Bohr atomic model for silicon. (b) rectifier diodes and special purpose diodes such as zener and LED. The students will acquire an appreciation of how diodes are useful and widespread in electronic circuitry such as power supplies. (c) The students will

have a solid grounding in Bipolar Junction Transistors and how these are used in switching and amplifications applications. (d) FETs will similarily be studied and students will learn of their prevelance in modern electronics. (e) The basics of digital electronics such as logic gates and boolean logic will be developed as part of this course. This material aims to blend with the other course content and so the basics of CMOS logic operations using transistors will be lectured. The course will prepare students to apply engineering and scientific knowledge in carrying out analysis, problem solving and design projects related.
Assessment: Coursework (40%), Exam (60%)

EEE2044S INTRODUCTION TO POWER ENGINEERING
16 NQF credits at HEQSF level 6
Convener: Associate Professor P Barendse
Course entry requirements: MAM1020S, PHY1013S and EEE1007S
Course outline:
This course aims to help students understand the basic concepts to (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; concept, (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, Thurs, Fri, 3rd period
DP requirements: 100% Lab attendance
Assessment: Labs (2%), Project (8%), Tests (30%), Exams (60%)

EEE2045F ANALOGUE ELECTRONICS
16 NQF credits at HEQSF level 6
Convener: Associate Professor D O'Hagan
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%), Quiz (5%), Exam (60%)

EEE2046F EMBEDDED SYSTEMS I
16 NQF credits at HEQSF level 6
Convener: Ms RA Verrinder
Course entry requirements: EEE1006F, CSC1015F, CSC1016S
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 and tutorial 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: None
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: 100% 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

EEE2049W INTRO TO ELECTRICAL AND ELECTRONIC ENGINEERING: SCIENCE STUDENTS
24 NQF credits at HEQSF level 6
Convener: Associate Professor S Chowdhury
Course entry requirements: PHY1013S, MAM1021S

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) Simple Magnetic Circuits; (e) 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 similarily be studied and students will learn of their prevelance in modern electronics. (e) The basics of digital electronics such as logic gates and 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, Wed, Thurs, 5th period (2nd Semester)
DP requirements: 1) 100% Lab attendance and submission 2) satisfactory completion of project and attendance at class tests 3) 50% mark for laboratories
Assessment: 1st semester - 5% Project, 35% Class Test, 60% June Exam; 2nd semester - 10% Assignments 30% Class Tests, 60% November exam

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EEE2050F EMBEDDED SYSTEMS I FOR SCIENCE STUDENTS
18 NQF credits at HEQSF level 6
Convener: Ms RA Verrinder
Course entry requirements: CSC1015F, CSC1016S
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 and tutorial submission
Assessment: Practicals (15%), Tests (20%), Project (5%), Exam (60%)

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

EEE3017W DIGITAL ELECTRONICS
Not for EC students.
16 NQF credits at HEQSF level 7
Convener: Dr M. Y. Abdul Gaffar
Course entry requirements: EEE2039W or equivalent.

Course outline:
This course aims to build on the understanding of**:** logic design, algorithmic state machines, data converters, advanced microcontroller usage, C application to microcontrollers; popular interface standards; common digital devices, instrument busses automated instrumentation and process control.
Lecture times: Semester 1: Mon 2nd, Tues 3rd period. Semester 2:Mon 5th and Tues 4th period.
DP requirements: 1) 100% Laboratory attendance and submission, 2) 50% mark for laboratories, 3) Complete ELO 5 assessments satisfactorily
Assessment: Class Tests (35%), Practicals (10%), November Examination (55%)

EEE3031S ENERGY UTILIZATION
for ME students only
10 NQF credits at HEQSF level 7
Convener: Associate Professor MA Khan
Course entry requirements: EEE2038W or equivalent.
Course outline:
Lecturers: Associate Professor MA Khan, Associate Professor P Barendse
Module A of EEE3057S. This course on energy utilisation aims to provide an introduction to the features, characteristics and operation of three phase AC induction and synchronous machines; and power electronics.
Lecture times: Tues 2nd period, Thurs 3rd period.
DP requirements: 100% Laboratory attendance and submission and 50% mark for laboratories
Assessment: Class Tests (35%), Project (5%), November Examination (60%).

EEE3044S ENERGY CONVERSION & UTILISATION
For Electrical and Computing, Electro-Mechanical and Mechanical Engineering students only.
8 NQF credits at HEQSF level 7
Convener: Professor K A Folly
Course entry requirements: EEE2031S or EEE2026S or EEE2041F.
Course outline:
Lecturers: Professor KA Folly, Mrs K Awodele
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%).

EEE3055W ELECTROMAGNETIC ENGINEERING
20 NQF credits at HEQSF level 7
Convener: Associate Professor AJ Wilkinson
Course entry requirements: EEE2039W, MAM2083F, PHY2010S.
Course outline:
Divided into Modules A and B.

Module A:Electromagnetic Field Theory
Lecturer: Associate Professor A Wilkinson
Outline: This module aims to develop an advanced understanding of electromagnetic field theory in an electrical engineering context. Time-varying electromagnetic fields; Maxwell's equations; continuity and displacement current; basis of Kirchhoff's laws; propagation of plane waves in lossless and lossy media; power density and Poynting vector; reflection and refraction of plane waves; and antenna radiation.
Lecture times: 2nd Semester: Wed, 3rd & 4th period, Thurs, Fri 2nd period.
DP requirements: Attendance at tutorial and laboratory sessions. Submission of laboratory report.

Assessment: Class Tests (20%), Laboratory Reports (10%), November Examination (70%).

Module B: Transmission Line Theory
Lecturer: Emeritus Professor M Reineck
Outline: This module provides an introduction to transmission lines for low and high frequency engineering. Topics include: overhead 3-phase power transmission lines. Short, medium and long line models. RF and microwave transmission lines, coaxial lines, microstrip, wave guides and fibre optic transmission lines. Equivalent circuit and line constants, two port equations, propagation, attenuation and phase constant, characteristic impedance, incident and reflected waves, reflection coefficient, the Smith Chart, standing waves, high frequency loss-less lines, and line matching examples.
Lecture times: 1st Semester: Tues, Wed, 4th period.
DP requirements: Completion of laboratory session and submission of report.
Assessment: Laboratories (10%), Class Test (10%), June Examination (80%).

EEE3057S POWER ENGINEERING
20 NQF credits at HEQSF level 7
Convener: Associate Professor MA Khan
Course entry requirements: EEE2038W or equivalent.
Course outline:
Module A: Energy Utilization
Lecturers: Associate Professor MA Khan, Associate Professor P Barendse
Course Outline: This module on energy utilisation aims to provide an introduction to the features, characteristics and operation of three phase AC induction and synchronous machines; and power electronics.
Lecture times: Tues 2nd period, Thurs 3rd period.
DP requirements: 100% Laboratory attendance and submission and 50% mark for laboratories.
Assessment: Class Tests (35%), Project (5%), November Examination (60%).

Module B: Introduction to Power Systems
Lecturers: MrsK Awodele, Professor KA Folly
Course Outline: This module aims to provide an introduction to power systems engineering, power systems network models, load flow and balanced fault calculations, 3-Phase transformers, protection principles, electrical loads and tariffs.
Lecture times: Mon, Wed, 2nd period.
DP requirements: 1) 100% Laboratory attendance and submission, 2) 50% mark for laboratories, 3)100% attendance of site visits where appropriate
Assessment: Laboratories (6%), Site Visit & Assignments (6%), Class Tests (28%), November Examination (60%).

EEE3061W MECHATRONICS DESIGN I
For Mechatronics and Electro-Mechanical Engineering students only.
12 NQF credits at HEQSF level 7
Convener: Dr A Patel
Course entry requirements: EEE2038W, EEE2039W, EEE2031S.
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: Mon, 3rd period.
DP requirements: Completion of projects
Assessment: Projects (40%), Class Test (10%), November Examination (50%).

EEE3062F DIGITAL ELECTRONICS

For Electro-Mechanical Engineering students only.

12 NQF credits at HEQSF level 6; 36 lectures, 5 laboratories.

Convener: Ms RA Verrinder

Course entry requirements: EEE2042S

Course outline:

This course aims to give students a strong foundation in digital electronics by introducing them to digital system fundamentals, including: information representation, Boolean algebra, logic gate behaviour, combinational and sequential digital circuits, digital building blocks and state machines.

Lecture times: Mon, Tues, Thurs 3rd period

DP requirements: 1) 100% lab and tutorial attendance, 2) 50% mark for laboratories

Assessment: Laboratories (10%), Class Tests (30%), June Examination (60%).

EEE3063F TRANSMISSION LINES

For EC students only

10 NQF credits at HEQSF level 7

Convener: Associate Professor AJ Wilkinson

Course entry requirements: EEE2038W, EEE2039W, MAM2083F

Course outline:

Lecturer: Emeritus Professor M Reineck

Module B of EEE3055W. This module provides an introduction to transmission lines for low and high frequency engineering. Topics include: Overhead 3-phase power transmission lines. Short, medium and long line models. RF and microwave transmission lines, coaxial lines, microstrip, wave guides and fibre optic transmission lines. Equivalent circuit and line constants, two port equations, propagation, attenuation and phase constant, characteristic impedance, incident and reflected waves, reflection coefficient, the Smith Chart, standing waves, high frequency loss-less lines, and line matching examples.

Lecture times: Tues, Wed, 4th period

DP requirements: Completion of laboratory sessions and submission of laboratory report.

Assessment: Laboratories (10%), Class Test (10%), June Examination (80%).

EEE3064W DIGITAL ELECTRONICS & MICROPROCESSORS

16 NQF credits at HEQSF level 7

Convener: Mr S Ginsberg

Course entry requirements: EEE2039W

Course outline:

Lecturers: Mr L Mohapi; Mr S Ginsberg

This course aims to develop an advanced understanding of digital electronics with emphasis on VHDL, algorithmic state machine design methods and computer architecture.

Lecture times: Sem 1: Thurs, Fri 4th period. Sem 2: Tues, Fri 3rd period.

DP requirements: Completion of at least half of the laboratories and minimum of 40% in at least two class tests

Assessment: Tutorials and Laboratories (10%), Tests (24%), November Examination (66%).

EEE3067W DIGITAL ELECTRONICS & MICROPROCESSORS

For Science students only. Please see the Science Faculty Handbook for further details.

24 NQF credits at HEQSF level 7

Convener: Dr A Patel

Course outline:

Refer to EEE3064W and EEE4096F.

Assessment: As for EEE3064W and EEE4096F Credit weighted

EEE3068F ELECTRONIC CIRCUITS
12 NQF credits at HEQSF level 7
Convener: Associate Professor AK Mishra
Course entry requirements: EEE2038W, EEE2039W
Course outline:
This course aims to develop an advanced understanding of frequency analysis of circuits. Topics include: manual Bode plot techniques for plotting magnitude and phase, breakpoints analysis. Operational amplifiers; design of circuits using opamps, practical limitations, frequency response, stability. Noise in circuits. Introduction to analogue filters. Oscillators. Use of Spice-based simulation software to simulate electronic circuits. Laboratory practicals in building and testing of circuits on bread-board, power supplies, switched mode circuits, and mixed signal systems.
Lecture times: Mon, Tues, Wed, 5th period
DP requirements: Completion of all Laboratory experiments successfully
Assessment: Assignments (15%), Class Test (25%), June Examination (60%).

EEE3069W CONTROL ENGINEERING
Electrical and Mechatronics Students only.
20 NQF credits at HEQSF level 7; Tutorials as required, practicals as required, design project..
Convener: Mr MS Tsoeu
Course entry requirements: MAM2084S/F, EEE2035F, EEE2038W, EEE2039W.
Course outline:
Module A (1st Semester): Lecturer: Professor E Boje
10 NQF credits at level 7; 36 lectures, tutorials as required, practicals as required, design project.
Outline: This module aims to develop an advanced understanding of control engineering. Topics include: Terminology: open and closed loop configurations, block diagrams, dynamic system modelling, transient response, steady state error criterion. System stability: Routh Hurwitz criterion, Root Locus. Frequency response: Nyquist plots, Bode diagrams, Nichols Charts. Compensation: Lead-lag circuits, minor loops, feed forward and three-term controllers. Sensitivity analysis and identification techniques are also covered.
Lecture times: Mon, Wed, Fri 3rd period
DP Requirements: 1) 100% Laboratory attendance, 2) Completion of all assigned class work, 3) Pass ECSA ELO 3 evaluation
Assessment: Semester mark (20%), June Examination (30%)

Module B (2nd Semester): Lecturer: Mr MS Tsoeu
10 NQF credits at level 7; 24 lectures, tutorials as required, practicals as required, design project.
Outline: This module aims to develop an advanced understanding of sampled data systems: Topics include: z-transforms, hold circuits, pulse transfer 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: Tues, Thurs 5th period.
DP Requirements: 1) 100% Laboratory attendance, 2) Completion of all assigned class work
Assessment: Semester mark (20%), November Examination (30%)

Overall Assessment for EEE3069W: Year Mark (40%), Examination (60%) (1st sem plus 2nd sem)
Assessment: Year mark (40%), November Examination (60%)

EEE3070S MEASUREMENT & MICROPROCESSORS
For Electro-Mechanical Engineering students.
8 NQF credits at HEQSF level 6; 24 lectures.
Convener: Ms J Mwangama
Course outline:
Lecturer: Ms J Mwangama

This module aims to introduce students to how a microcontroller works and how to develop microcontroller based systems. It contains a strong practical element in terms of setting up a development toolchain and writing code in both assembly and C. In order to facilitate this learning, students will build a microcontroller development kit, write and debug code and interface with peripheral modules such as GPIO pins, ADCs and timers. Interrupts will also be explored.
Lecture times: Thurs, Fri, 3rd period
DP requirements: 50% average for practical exams
Assessment: Group practicals (15%), Class test (5%), Tutorials (10%), Practical exam (10%), November exam (60%)

EEE3073S PROFESSIONAL COMMUNICATION STUDIES
For Electrical Engineering, Electrical and Computer Engineering and Mechatronics students. Second-year students may not register for EEE3073S.
12 NQF credits at HEQSF level 7
Convener: Associate Professor J English
Course entry requirements: All first year courses plus 72 credits of second year courses completed.
Course outline:
This course in professional communication aims to develop effective reporting. It covers the requirements for written and oral reports in terms of planning, organisation and selection of information, as well as linguistic style and final presentation. Students will need to demonstrate proficiency in both formats.
Lecture times: Fri, 4th & 5th period
DP requirements: 100% Attendance and 50% minimum class test average
Assessment: Projects (37.5%), Class Test (12.5%), Oral Examination (25%), November Examination (25%).

EEE3074W EMBEDDED SYSTEMS
20 NQF credits at HEQSF level 7
Convener: Dr A. Patel
Course entry requirements: CSC2001F, CSC2002S, EEE2039W or equivalent.
Course outline:
Lecturers: Dr A Patel; Dr Y Abdul Gaffar
This course aims to provide an advanced introduction to the design and programming of an embedded system, controlled, for example, by a RISC processor. After the initial embedded coding practice, the tool chains for loading, testing and debugging the code are introduced, followed by more advanced topics of hardware/software interfacing. By the end of the course embedded operating systems are used. The implications of multitasking, realtime operations, safety and maintenance are covered.
Lecture times: Semester 1: Tues, Thurs 6th period. Semester 2: Weds, Thurs. 3rd period.
DP requirements: 1) Completion of all labs, 2) Pass ECSA ELO 5 evaluations
Assessment: Quizzes (20%), Laboratory & Practicals (10%), Projects (20%), June Examination (25%), November Examination (25%)

EEE3077W DIGITAL & EMBEDDED SYSTEMS
For Science students only. Please see the Science Faculty Handbook for further details.
36 NQF credits at HEQSF level 7
Convener: Dr A Patel
Course outline:
EEE3064W and EEE3074W
DP requirements: As for EEE3064W and EEE3074W
Assessment: As for EEE3064W and EEE3074W. Credit weighted

EEE3078W DIGITAL EMBEDDED & ADAPTIVE SYSTEMS
For Science students only. Please see the Science Faculty Handbook for further details.
48 NQF credits at HEQSF level 7
Convener: Dr A Patel
Course outline:
EEE3064W, EEE3074W and EEE4096F
DP requirements: As for EEE3064W, EEE3074W and EEE4096F
Assessment: As for EEE3064W, EEE3074W and EEE4096F. Credit weighted

EEE3079W EMBEDDED & ADAPTIVE SYSTEMS
For Science students only. Please see the Science Faculty Handbook for further details.
28 NQF credits at HEQSF level 7
Convener: Dr A Patel
Course outline:
EEE3074W and EEE4096F
DP requirements: As for EEE3074W and EEE4096F.
Assessment: As for EEE3074W and EEE4096F. Credit weighted

EEE3081F CONTROL ENGINEERING A
For Electrical and Computer Engineering Students only.
10 NQF credits at HEQSF level 7
Convener: Professor E Boje
Course entry requirements: MAM2084S/F, EEE2035F, EEE2038W, EEE2039W.
Course outline:
Lecturer: Professor E Boje
This module aims to develop an advanced understanding of control engineering. Topics include: Terminology: open and closed loop configurations, block diagrams, dynamic system modelling, transient response, steady state error criterion. System stability: Routh Hurwitz criterion, Root Locus. Frequency response: Nyquist plots, Bode diagrams, Nichols Charts. Compensation: Lead-lag circuits, minor loops, feed forward and three-term controllers. Sensitivity analysis and identification techniques are also covered.
Lecture times: Mon, Wed & Fri, 3rd period
DP requirements: 1) 100% Laboratory attendance, 2) Completion of all assigned class work, 3) Pass ECSA ELO3 evaluation.
Assessment: Year Mark (40%), June Examination (60%)

EEE3082S CONTROL ENGINEERING B
For Electrical and Computer Engineering Students only.
10 NQF credits at HEQSF level 7
Convener: Mr MS Tsoeu
Course entry requirements: EEE3081F (DP).
Course outline:
Lecturer: Mr MS Tsoeu
This course aims to develop an advanced understanding of sampled data systems: z-transforms, hold circuits, pulse transfer 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: Tues, Thurs, 5th period
Assessment: Year Mark (40%), November Examination (60%)

EEE3083F COMMUNICATION SYSTEM & NETWORK DESIGN 1

12 NQF credits at HEQSF level 7; 36 lectures; tutorials and practicals as required.

Convener: Associate Professor OE Falowo

Course entry requirements: EEE2039W

Course outline:

Lecturers: Associate Professor OE Falowo

This course is an advanced 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, Orthogonal frequency shift keying, and QPSK.

Lecture times: Mon, Wed, Fri 1st period.

DP requirements: Completion of laboratory assignments and tutorials, at least 50% for laboratory assignments.

Assessment: Tutorials & Laboratories (14%), Class Test (36%), June Examination (50%).

EEE3084W COMMUNICATION SYSTEM & NETWORK DESIGN

24 NQF credits at HEQSF level 7

Convener: Associate Professor OE Falowo

Course entry requirements: EEE2039W

Course outline:

Divided into Modules A and B.

Module A (First Semester): Communication system and network design I

12 NQF credits at level 7; 36 lectures; tutorials and practicals as required.

Lecturers: Associate Professor OE Falowo

Outline: This module is an advanced 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, IPv6,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, Orthogonal frequency shift keying, and QPSK.

Lecture times: Mon, Wed, Fri 1st period.

DP requirements: 100% Completion of laboratory assignments and tutorials; minimum of 50% for laboratory assignments.

Assessment: Tutorials and Laboratories (14%), Class Test (36%), June Examination (50%).

Module B (Second Semester): Communication system and network design II

12 NQF credits at level 7; 36 lectures; tutorials and practicals as required.

Lecturers: Associate Professor OE Falowo and Ms J Mwangama

Outline: This module aims to develop an advanced understanding of theTransport 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, equalisation, bandpass demodulation / detection schemes with ASK, FSK, PSK, probability or error with bandpass detection, and MSK.
Lecture times: Wed, Thurs, Fri 1st period.
DP requirements: 100% Completion of laboratory assignments and tutorials; minimum of 50% for laboratory assignments.
Assessment: Tutorials and Laboratories (14%), Class Test (36%), November Examination (50%).

EEE3085S COMMUNICATION SYSTEMS &NETWORK DESIGN 2

Telecommunication Stream: This fundamental course in telecommunication is pre-requisite to all 4th year telecommunication courses.
12 NQF credits at HEQSF level 7; 36 lectures; tutorials and practicals as required..
Convener: Associate Professor OE Falowo
Course entry requirements: EEE2039W, EEE3083F
Course outline:
Lecturers: Associate Professor OE Falowo and Ms J Mwangama
This course aims to develop an advanced understanding of the 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, equalisation, bandpass demodulation / detection schemes with ASK, FSK, PSK, probability or error with bandpass detection, and MSK.
Lecture times: Wed, Thurs, Fri, 1st period
DP requirements: 100% completion of laboratory assignments and tutorials; minimum of 50% for laboratory assignments
Assessment: Tutorials & Laboratories (14%), Class Test (36%), Written examination (50%).

EEE3086F SIGNALS & SYSTEMS II

12 NQF credits at HEQSF level 7
Convener: Associate Professor AJ Wilkinson
Course entry requirements: EEE2035F, EEE2036S (co-requisite also accepted)
Course outline:
This course aims to develop an advanced understanding of signals and systems. Topics include: time domain and fourier domain analysis of linear systems. Power spectral density. Propagation of signals through linear systems. Filter concepts. Noise in linear systems. Calculation of signal to noise ratio. Decibel calculations. Amplitude modulation and demodulation. Frequency division multiplexing. Heterodyning (shifting in frequency). Angle Modulation. Applications: telecommunications transmitters and receivers; instrumentation. Some examples of non-linear systems will also be discussed; for example the generation of harmonics at the output of a non-linear time-invariant system.
Lecture times: Mon, 4th period; Thurs, Fri, 5th period
DP requirements: Submission of all drill problems, assignments and laboratory reports. Attendance at tutorial sessions.
Assessment: Tutorials and laboratories (10%), Class Tests (20%), June Examination (70%).

EEE3087S ELECTROMAGNETIC FIELD THEORY

10 NQF credits at HEQSF level 7

Convener: Associate Professor AJ Wilkinson

Course entry requirements: MAM2083F, EEE2038W, EEE2039W, PHY2010S (or approved equivalents)

Course outline:

Module A of EEE3055W: This module aims to develop an advanced understanding of electromagnetic field theory in an electrical engineering context. Time-varying electromagnetic fields; Maxwell's equations; continuity and displacement current; basis of Kirchhoff's laws; propagation of plane waves in lossless and lossy media; power density and Poynting vector; reflection and refraction of plane waves; and antenna radiation.

Lecture times: 2nd Semester: Wed, 3rd & 4th period, Thurs, Fri 2nd period.

DP requirements: Attendance at tutorial and laboratory sessions. Submission of laboratory report.

Assessment: Class Tests (20%), Laboratory Reports (10%), November Examination (70%).

EEE4001F DIGITAL SIGNAL PROCESSING

20 NQF credits at HEQSF level 8; Tutorials and practicals as required.

Convener: Associate Professor F Nicolls

Course entry requirements: EEE3086F or EEE3069W or equivalent.

Course outline:

Lecturers: Professor A Baghai-Wadji and Associate Professor F Nicolls

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 theory and application of wavelets and frames.

Lecture times: Wed 3rd & 4th period; Thurs & Fri 4th period

DP requirements: Satisfactory completion of coursework.

Assessment: Project & Assignments (20%), Class Test (20%), June Examination (60%).

EEE4006F PROFESSIONAL COMMUNICATION STUDIES

For Electrical Engineering, Electrical and Computer Engineering and Mechatronics students.

8 NQF credits at HEQSF level 8

Convener: Associate Professor J English

Course entry requirements: EEE3073S

Co-requisites: EEE4051F

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) 100% attendance and 50% minimum class test average. 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/F RESEARCH PROJECT

40 NQF credits at HEQSF level 8

Convener: 1st sem: Associate Professor D O'Hagan and 2nd sem: Dr DTO Oyedokun

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 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%)

EEE4051F NEW VENTURE PLANNING
8 NQF credits at HEQSF level 8
Convener: Professor P Martinez
Course entry requirements: EEE2038W, EE2039W or equivalent, EEE3073S, MAM2084S
Co-requisites: EEE4006F
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 5
Assessment: Test (10%), Business Plan (60%), Two hour exam (30%).

EEE4084F DIGITAL SYSTEMS
20 NQF credits at HEQSF level 8
Convener: Dr S Winberg
Course entry requirements: CSC3021F, EEE3064W or EEE3017W (>70%).
Course outline:
This advanced course in digital systems aims to develop an understanding of the design of high performance and special-purpose digital computing systems. Topics include: design and programming of parallel processors, reconfigurable computing, and application-specific parallel processing accelerators with consideration of intellectual property and VLSI aspects of these products. The course is divided into two parts, one part per term. Part 1 covers parallel computing principles and techniques; part 2 involves designing and prototyping application accelerators using Hardware Description Languages (HDLs) and FPGA platforms. This course has a significant portion of project-based learning, together with theory delivered in lectures. There are four practicals: Part 1 practicals cover Octave, Pthreads, MPI and OpenCL for GPU programming. Part 2 has one practical involving the Verilog HDL and familiarizing students with an FPGA platform. There are two projects in this course: Part 1 has a smaller project concerning the design of special-purpose processor architecture. The Part 2 is a larger project and involves the design and prototyping of an FPGA-based accelerator implemented using a FPGA evaluation platform. The lecture sessions include presentations by lecturers, seminars and workshops during which students learn fundamental theories, brainstorm ideas, and discuss influential and recent publications in the field.
Lecture times: Tues 2nd & 7th periods; Thurs 6th & 7th periods

DP requirements: Coursework assessment mark of at least 40%.
Assessment: Tutorials & Laboratories (10%), Projects (20%), Class Test (20%), June Examination (50%).**Website:** http://www.rrsg.uct.ac.za/EEE4084F

EEE4086F MICROWAVE ENGINEERING
16 NQF credits at HEQSF level 8
Convener: Emeritus Professor BJ Downing
Course entry requirements: Prerequisites: All 2nd Year core courses, 72 credits of 3rd Year core courses.
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: Mon & Wed, 5th period & Meridian. Practicals: Mon, 6th & 7th period.
DP requirements: Submission of practical assignment and satisfactory attendance of practicals
Assessment: Class test (20%), Practical assignments (30%), June Examination (50%).

EEE4087F MOBILE BROADBAND NETWORKS
20 NQF credits at HEQSF level 8
Convener: Associate Professor O Falowo
Course entry requirements: EEE3055W or EEE3063F; EEE3085S, EE3083F, EEE3084W, EEE3086F or equivalent.
Course outline:
This advanced course aims to develop an understanding of mobile broadband networks and includes selected topics in (1) wireless and fixed access networks (16 lectures), (2) broadband networks (16 lectures), and (3) networks and services management (16 lectures).

Wireless and Fixed Access Networks: Lecturer: Associate Professor O Falowo
Wireless Network Fundamentals (architecture and components, protocols and standards, cellular concept and cellular system fundamentals, call splitting and sectoring). Wireless Access Technologies (GSM and General Packet Radio Service 2.5G Wireless, 3G Wireless, 4G Wireless, and 5G Wireless Networks. Wireless LAN, Bluetooth Network, Ad hoc Networks, Sensor Area Networks, and Heterogeneous Wireless Networks). Fixed Access Networks, Radio Resource Management, and Mobility Management.

Broadband Networks: Lecturer: Ms J Mwangama
TCP Traffic Control, Traffic and Congestion Control in ATM Networks, Performance Evaluation of Communication Networks, QoS in Packet Networks, QoS Metrics, IP QoS Functional Requirements, IP Integrated Services and Differentiated Services, QoS in ATM networks; IP Traffic Engineering; Router Architectures and IP Address Lookup Algorithms; Quality of Service Routings; Deploying Quality of Service. Network Convergence; Network Trends; Evolution and Market Internetworking; Hierarchical TDM networks, Internet, LAN/SOHO and Access Networks, WAN application requirements; Software Defined Networks.

Networks and Services Management: Lecturer: Dr A Murgu
Mathematical Analysis, Computer Simulations and Markov Analysis, Networks on Queues, Traffic Characterisation for Broadband Services ,QoS; Service Platforms, AAA, VoIP, API (Parlay, JAIN); Next Generation Networks; Multiservice platforms, Soft-switch, Data Plane Technology, Multiplexing, Routing, MPLS, Routing and Traffic Engineering with MPLS, L2/L3/L4, switching;

Control Plane Technology, Signalling, Call Set Up and Connection Control (SS7, H.323, SIP, MGCP); Applications: Telephony, Packet voice, Streaming.
Lecture times: Mon 2nd, Tues, Thurs, Fri, 3rd periods
DP requirements: 1) 100% Tutorial submission and lab attendance. 2) Pass ECSA ELO evaluations in the projects. 3) 50% Lab Mark.
Assessment: Tutorials, Laboratory and Projects (35%), Class Test (15%), June Examination (50%).

EEE4088F COMMUNICATION ENGINEERING
16 NQF credits at HEQSF level 8; Practical exercises and tutorials as required, and design projects..
Convener: Associate Professor M Dlodlo
Course entry requirements: EEE3086F or equivalent.
Course outline:
The course aims to enhance an understanding of and competence in analysing and possibly designing contemporary digital communication systems, and to extend the study of principles of communication engineering towards current topics including selections from: Elements of information theory, error-control coding, random processes and spectral analysis, sources, source coding and baseband signalling, bandpass modulation and demodulation/detection, synchronisation, resource allocation, communication link analysis, and examples of system design.
Lecture times: Mon 5th; Wed,Thurs, Fri, 2nd period
DP requirements: Minimum 40% class marks in completion of coursework
Assessment: Semester mark (40%), June Examination (60%).

EEE4089F POWER DISTRIBUTION & TRANSMISSION NETWORKS
20 NQF credits at HEQSF level 8
Convener: Mrs K Awodele
Course entry requirements: EEE3057S
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, electrification, delivery process and pricing, substations, distributed generation, power system protection, high voltage engineering, and power system reliability and power quality.
Lecture times: Wed 3rd & 4th; Thurs & Fri 4th periods
DP requirements: 1) 100% Laboratory attendance and submission. 2) At least 50% mark for laboratories.3) Pass ECSA ELO 1 & 2 evaluations, 4) 100% attendance of site visits
Assessment: Laboratory Assignments (10%), Project and Site Visits (10%), Class Tests (20%), June Examination (60%).

EEE4090F POWER SYSTEMS ANALYSIS, OPERATION & CONTROL
20 NQF credits at HEQSF level 8
Convener: Professor K A Folly
Course entry requirements: EEE3057S
Course outline:
Lecturers: Associate Professor KA Folly and Dr DTO Oyedokun
This course aims to develop an advanced understanding of power systems analysis, operation and control. Topics include: Load flow studies, fault calculation, power system operations, power system stability and control, grid connections of distributed generator (DG), high voltage DC transmissions systems and electricity market.
Lecture times: Monday, 2nd & 8th period; Tuesday, 1st & 3rd period
DP requirements: 1) Satisfactory completion of coursework 2) Continuous assessment mark of at least 40% based on test marks
Assessment: Projects (16%), Class Test (24%), June Examination (60%).

EEE4093F PROCESS CONTROL & INSTRUMENTATION

20 NQF credits at HEQSF level 8

Convener: Mr MS Tseou

Course entry requirements: EEE3069W or equivalent

Course outline:

Lecturers: Professor E Boje, Associate Professor KA Folly, Mr MS Tseou, Ms R Verrinder

This course aims to provide an integrated view of the principles and practice of modern industrial control and its applications. Topics include: 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.

Lecture times: Mon 6th, Wed 6th, Fri 6th and 7th period.

DP requirements: 1) 100% Laboratory attendance and submission. 2) Completion of all assigned class work 3) Pass ECSA ELO 1 & 2 evaluations.

Assessment: Project (20%), Assignments & Class Tests (20%), June Examination (60%)

EEE4096F NEURAL, FUZZY & EVOLVING SYSTEMS

8 NQF credits at HEQSF level 8; Project/s..

Convener: Emeritus Professor J Greene

Course entry requirements: All third year core courses

Course outline:

This advanced course aims to develop an understanding of neural, fuzzy and evolving systems. Topics include: an introduction to pattern recognition, machine learning and stochastic optimisation. In addition the course provides practical hands-on introduction to programming in Matlab with additional introductory tutorials for those unfamiliar with Matlab.

Lecture times: Tuesday &Wednesday, 6th period

DP requirements: 80% submission of all assignments, satisfactory completion of hands-on proficiency test.

Assessment: November examination 2 hours

EEE4099F ELECTRICAL MACHINES & POWER ELECTRONICS

20 NQF credits at HEQSF level 8

Convener: Associate Professor M A Khan

Course entry requirements: EEE3031S or EEE3057S or equivalent.

Course outline:

Lecturers: Associate Professor MA Khan, Professor P Pillay

This course aims to develop an advanced understanding of electrical machines and power electronics. Topics include: Switching and conduction losses of power semi-conductor devices. Uncontrolled and controlled naturally commutated/converters. DC to DC converters; Power & Power factors in non-sinusoidal systems. Unipolar and bipolar pulse width modulated schemes. Space vector modulation, Half-bridge and full-bridge configurations for single and three phase converters. The analytical models of DC and AC machines are analysed and methods of achieving speed control are discussed. The characteristics of each machine under variable speed operation are studied. Modern four-quadrant DC and AC Drive topologies are discussed together with their control objectives and performance. Topics on specialised electrical machines are also presented.

Lecture times: Mon 3rd & 4th; Thurs & Fri 5th

DP requirements: 1) 100% Laboratory attendance and submission. 2) 50% mark for laboratories

Assessment: Project (5%), Class Tests (35%), June Examination (60%).

EEE4101F NUCLEAR POWER ENGINEERING
20 NQF credits at HEQSF level 8; 3 Lab sessions.
Convener: Associate Professor M A Khan
Course entry requirements: EEE3057S or EEE3044S
Course outline:
Lecturers: Professor CT Gaunt, Associate Professor MA Khan, Mrs R Smit, Ms R Verrinder, Professor DG Aschman, Dr S Petersen

Common discipline component (24 lectures)
This advanced course aims to develop an understanding of nuclear power engineering. Topics include: Development of nuclear engineering: atomic models, relativity, x-rays, nuclear reactions Introduction to nuclear engineering: radioactivity, nuclear and neutron physics, radiation protection, fission and fusion reactor concepts. Nuclear fuel cycle: production, handling and use of nuclear fuel and the safe disposal of waste Nuclear reactor theory: introduction to neutron diffusion theory, neutron moderation, conditions for criticality of nuclear reactors, heat extraction, reactor statics and dynamics, shut down and restart. Materials in nuclear engineering: interaction of radiation with matter Radiation protection: theory and practice of radiation dosimetry, Reactor engineering and design. Environmental aspects: evaluation of effects of radioactivity added to the environment by human activities Regulatory: reactor operator licensing, nuclear safety, and reactor operations.

Electrical engineering component (24 lectures) Nuclear energy: global and national energy requirements, integration of nuclear power with other sources. Nuclear power plant systems: conventional and advanced generation power reactors, coupling of reactor and power plant, nuclear simulators; electrical systems in nuclear engineering: design methodology, problem formulation, criteria, trade-off decisions and design optimization; case studies. Instrumentation: behaviour of various nuclear radiation detectors; design and application of radiation dosimeter systems for personnel monitoring, area radiation monitoring and accident situation, nuclear reactor flux distributions, temperatures and transients. Control systems: measurement and control of fundamental parameters for nuclear plant operation and safety.
Lecture times: Tuesday & Thursday: 2nd period, Monday & Wednesday: 5th period
DP requirements: 1) 100% Laboratory attendance and submission. 2) 50% mark for laboratories. 3) 100% Attendance of site visit where appropriate
Assessment: Tutorials, Labs, Projects and Assignments (10%), Class Tests (15%), June Examination (75%).

EEE4103F NUCLEAR POWER SOURCES
For Mechanical, Electro-mechanical and Chemical Engineering students only.
12 NQF credits at HEQSF level 8; 3 Lab sessions.
Convener: Associate Professor M A Khan
Course entry requirements: EEE3044S or 2nd year Chemical Engineering
Course outline:
Lecturers: Professor CT Gaunt, Professor DG Aschman, Dr S Petersen
Module A of EEE4101F
This advanced course aims to develop an understanding of nuclear power sources. Topics include: Development of nuclear engineering: atomic models, relativity, x-rays, nuclear reactions Introduction to nuclear engineering: radioactivity, nuclear and neutron physics, radiation protection, fission and fusion reactor concepts. Nuclear fuel cycle: production, handling and use of nuclear fuel and the safe disposal of waste Nuclear reactor theory: introduction to neutron diffusion theory, neutron moderation, conditions for criticality of nuclear reactors, heat extraction, reactor statics and dynamics, shut down and restart. Materials in nuclear engineering: interaction of radiation with matter Radiation protection: theory and practice of radiation dosimetry, Reactor engineering and design. Environmental aspects: evaluation of effects of radioactivity added to the environment by human activities. Regulatory: reactor operator licensing, nuclear safety, and reactor operations.
Lecture times: Monday & Wednesday, 5th period

DP requirements: 1) 100% Laboratory attendance and submission, 2) 50% mark for laboratories, 3) 100% Attendance of site visit where appropriate.
Assessment: Tutorials, Labs, Projects, Assignments (10%), Class Tests (15%), Examination (75%).

EEE4104C ELECTRICAL MACHINES & DRIVES
10 NQF credits at HEQSF level 8
Convener: Associate Professor P Barendse
Course entry requirements: EEE3069W, EEE3031S or EEE3057S.
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, Thurs, Fri, 2nd periods
DP requirements: No requirements
Assessment: Tutorial (5%), Projects (10%), Class Tests (25%), September Examination (60%).

EEE4113C 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 organize 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: 50% Design Project, 50% Final Examination