NATIONAL DIPLOMA: ENGINEERING: ELECTRICAL
(Extended curriculum programme with foundation provision)
Qualification code: NDEEF2 - NQF Level 6

Campus where offered: Pretoria and eMalahleni campuses

Important notification to new applicants:
Students who intend to enrol for this qualification for the first time in 2017 or thereafter, should note that it will not be possible to continue with any Baccalaureus Technologiae as from 2020, since it is being replaced by qualifications aligned with the newly-implemented Higher Education Qualification Sub-Framework. Potential students are advised to consult the University's website for any new qualifications which might not be published in this Prospectus.

REMARKS

a. Admission requirement(s) and selection criteria:

- **FOR APPLICANTS WHO OBTAINED A SENIOR CERTIFICATE BEFORE 2008:**

  Admission requirement(s):
  A Senior Certificate or an equivalent qualification, with D symbols (50 – 59%) at Higher Grade or C symbols (60 – 69%) at Standard Grade for English and Mathematics, and an E symbol (40 – 49%) at Higher Grade or a D symbol (50 – 59%) at Standard Grade for Physical Science.

  Selection criteria:
  To be considered for the National Diploma, applicants must have an Admission Point Score (APS) of minimum **20** to **27** will be considered for the extended programme only.

  Assessment procedure:
  All applications received by the published due dates (as indicated on page 3) will be ranked according to the APS achieved. After consideration of the Departmental Student Enrolment Plan (SEP), only the highest ranked applicants will be accepted to fill the available places. A waiting list consisting of the remainder of the applicants will provide an opportunity for applicants to fill places created by accepted students failing to meet the enrolment dates.

- **FOR APPLICANTS WHO OBTAINED A NATIONAL SENIOR CERTIFICATE IN OR AFTER 2008:**

  Admission requirement(s):
  A National Senior Certificate with a bachelor's degree or a diploma endorsement, or an equivalent qualification, with an achievement level of at least 4 for English (home language or first additional language), 4 for Mathematics and 3 for Physical Sciences.

  Applicants who do not meet the above criteria for Mathematics and/or Physical Sciences for admission to the National Diploma or National Diploma (extended), may enrol for Mathematics N3/N4 and/or Engineering Sciences N3/N4 **or** Mathematics and/or Engineering Sciences, as presented as part of the National Certificate Vocational (NCV) at NQF Level 4, at any Technical and Vocational Educationand Training (TVET) College. If these subjects are successfully passed at a performance level of at least 60% (for the National Diploma), or 50% (National Diploma - extended), they may re-apply for admission to the qualification at the University.

  Selection criteria:
  To be considered for the National Diploma, applicants must have an Admission Point Score (APS) of at least **28**. Applicants with a score of 20 to 27 will be considered for the extended programme only.

Assessment procedure:
All applications received by the published due dates (as indicated on page 3) will be ranked according to the APS achieved. After consideration of the Departmental Student Enrolment Plan (SEP), only the highest ranked applicants will be accepted to fill the available places. A waiting list consisting of the remainder of the applicants will provide an opportunity for applicants to fill places created by accepted students failing to meet the enrolment dates.

- **FOR APPLICANTS WHO OBTAINED A QUALIFICATION FROM TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET) COLLEGES (PREVIOUSLY KNOWN AS FET COLLEGES):**

Applicants with a National Certificate (Vocational) at NQF Level 4:

Admission requirement(s):
A National Certificate (Vocational) at NQF Level 4 with a bachelor's degree or a diploma endorsement, issued by the Council for Quality Assurance in General and Further Education and Training (Umalusi), with at least 50% (APS of 4) for English and Mathematics, and at least 60% (APS of 5) for Physical Sciences/Applied Engineering Technology and any two other vocational subjects.

Selection criteria:
To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least **23**.

Applicants with a National N Certificate as published in Nated 191: N3 (NQF Level 4) and N4/N5/N6 (NQF Level 5):
A National Senior Certificate or a National N Certificate as published in Nated 191: N3 (NQF Level 4) and N4/N5/N6 (NQF Level 5) issued by the Council for Quality Assurance in General and Further Education and Training (Umalusi), with at least 50% (APS of 4) for English and 60% (APS of 5) for Mathematics N3 and Engineering Sciences N3.

Applicants will be exempted from certain subjects on the grounds of N4/N5/N6 subjects passed (a minimum of 50% of the qualification's subjects). Exemption will be granted from equivalent engineering subjects (including Mathematics and Engineering Sciences) passed with at least 60% (APS of 5).

Applicants with a National N Diploma (NQF Level 6):
Applicants with a National N Diploma (Nated 191: N6 with a Trade Certificate) issued by the Council for Quality Assurance in General and Further Education and Training (Umalusi), who obtained at least 60% for all subjects completed for N4/N5/N6 certificates at NQF Level 5 (including Mathematics and Engineering Sciences), will be –
- exempted from certain S1/S2 subjects on the grounds of N4/N5/N6 subjects passed (a maximum of 50% of the qualification's subjects); and
- exempted from Work-Integrated Learning I on the submission of a Trade Certificate at NQF Level 4.

b. *Minimum duration:*
Three and a half years.

c. *Presentation:*
Day classes. Classes and assessments may take place on Friday afternoons and/or Saturdays.

d. *Intake for the qualification:*
January only.

e. *Optional subjects:*
To orientate to a specific field in Electrical Engineering, students should consult the subject selection guide at the end of the previous qualification.

f. *Extended subjects:*
Should a student fail any of the subjects, the Faculty reserves the right to refer the student to Student Development and Support (SDS) for an evaluation and career guidance. A student will only be allowed to repeat extended subjects based on a favourable recommendation by Student Development and Support and the consideration of relevant mitigating factors meriting for re-submission.

g. *Class attendance/assessments, exclusion and readmission, additional costs, Work-Integrated Learning I and II, practicals, predicate marks for exam subjects, waiving of prerequisite subjects, and Recognition of Prior Learning (RPL), equivalence and status:*
See National Diploma: Engineering: Electrical (NDEE12).

h. *Subject credits:*
Subject credits are shown in brackets after each subject.

Key to asterisks:
* Information does not correspond to information on approved AA72.
(Deviations approved by the Senate in September 2011 and September 2015.)
** MEQ33XT and MEQ33YT must be taken concurrently and will count as one subject.

CURRICULUM

SUBJECTS PRINTED IN BOLD ARE NOT FOR REGISTRATION PURPOSES.

FIRST YEAR
Students who repeat a subject must register for a different subject code. Even though the credits are published as 0,000, the correct credit will reflect on the academic record once the subject is passed.

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
FPCOS03	Communication Skills (Extended) I	(0,050)	
FPCOSR3	Communication Skills (Extended) I (for repeaters)	(0,000)	
FPCSK02	Computer Skills (Extended) I	(0,050)	
FPCSKR2	Computer Skills (Extended) I (for repeaters)	(0,000)	
FPEEN01	Electrical Engineering (Extended) I	(0,100)	
FPEENR1	Electrical Engineering (Extended) I (for repeaters)	(0,000)	
FPELC01	Electronics (Extended) I	(0,100)	
FPELCR1	Electronics (Extended) I (for repeaters)	(0,000)	
FPESL01	Engineering Science (Extended) I	(0,100)	
FPESLR1	Engineering Science (Extended) I (for repeaters)	(0,000)	
FPMAT04	Mathematics (Extended) I	(0,100)	
FPMATR4	Mathematics (Extended) I (for repeaters)	(0,000)	
TOTAL CREDITS FOR THE FIRST YEAR:		**0,500**	

SECOND YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
FIRST SEMESTER			
After completion of all the extended subjects (see paragraph f in the remarks). Prerequisites do not apply to Work-Integrated Learning: Workshop I.			
DSY131T	Digital Systems I	(0,100)	

EEN211T	Electrical Engineering II	(0,100)	
ELC211T	Electronics II	(0,100)	
EXP1EEH	**Work-Integrated Learning I**		
EXP1EWT	Work-Integrated Learning: Workshop I*	(0,050)	
MAT271B	Mathematics II	(0,100)	
SFD201T	Software Design II*	(0,100)	

SECOND SEMESTER

DSY231T	Digital Systems II*	(0,100)	Digital Systems I
MAT351T	Mathematics III	(0,100)	Mathematics II
	plus one of the following subjects:		
EEN311T	Electrical Engineering III	(0,100)	Electrical Engineering II
ELC331T	Electronics III	(0,100)	Electronics II
	plus one of the following subjects:		
BIS101T	Bio-Systems I	(0,100)	
EMA241T	Electrical Machines II	(0,100)	Electrical Engineering II
ETC221T	Electronic Communication II	(0,100)	Electronics II
PCM221T	Process Instrumentation II	(0,100)	Engineering Science (Extended) I
	plus one of the following subjects:		
ELD331T	Electrical Distribution III	(0,100)	Electrical Engineering II
MEQ211T	Medical Equipment II	(0,100)	
SFD301T	Software Design III	(0,100)	Software Design II

TOTAL CREDITS FOR THE SECOND YEAR: **1,050**

THIRD YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
FIRST SEMESTER			
One of the following modules:			
DPJ301T	**Design Project III**		
DPJ30YT	Design Project: Light Current III*	(0,100)	Digital Systems II Electronics III
DPJ30ZT	Design Project: Heavy Current III*	(0,100)	Electrical Engineering III Electronics II
	plus one of the following subjects:		
CSY321T	Control Systems III	(0,100)	Mathematics III
MWC301T	Microwave Communication III	(0,100)	Electronic Communication II
	plus one of the following subjects:		
DSY341T	Digital Systems III	(0,100)	Digital Systems II
EMA341T	Electrical Machines III	(0,100)	Electrical Machines II
RAE311T	Radio Engineering III	(0,100)	Electronic Communication II
	plus one of the following subjects:		
EPC321T	Electrical Protection III	(0,100)	Electrical Engineering II

ETC301T	Electronic Communication III	(0,100)	Electronic Communication II
MEQ331T	**Medical Equipment III**		
MEQ33XT	Medical Equipment: Equipment III**	(0,100)	Bio-Systems I Digital Systems II Medical Equipment II
PCM321T	Process Instrumentation III	(0,100)	Process Instrumentation II
	plus one of the following subjects:		
LOD311T	Logic Design III	(0,100)	Digital Systems II
MEQ331T	**Medical Equipment III**		
MEQ33YT	Medical Equipment: Systems III**	(0,100)	Bio-Systems I Digital Systems II Medical Equipment II
PWE311T	Power Electronics III	(0,100)	Electronics II
TLV311T	Television III	(0,100)	Electronic Communication II
TOTAL CREDITS FOR THE SEMESTER:		0,500	

SECOND SEMESTER

EXP1EEH	**Work-Integrated Learning I**		
EXP1EYT	Work-Integrated Learning: Practice I*	(0,450)	
TOTAL CREDITS FOR THE THIRD YEAR:		**0,950**	

FOURTH YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
FIRST SEMESTER			
EXP2EEH	Work-Integrated Learning II*	(0,500)	Work-Integrated Learning I
TOTAL CREDITS FOR THE SEMESTER:		0,500	
TOTAL CREDITS FOR THE FOURTH YEAR:		**0,500**	
TOTAL CREDITS FOR THE QUALIFICATION:		**3,000**	

SUBJECT SELECTION GUIDE

The following is a guide to the optional subjects to orient to a specific field in Electrical Engineering (timetable will give priority to subjects as set out in the subject selection guide):

- **CLINICAL ENGINEERING**

  Field description:

  A career in clinical engineering relates to the maintenance, implementation and management of electrical and electronic equipment used in hospitals for the medical care and treatment of patients. The career involves finding solutions to engineering problems and the implementation and maintenance of medical equipment by applying sound scientific and technical knowledge and mathematical skills. Technicians and technologists are employed in public and private hospitals, by manufacturers and suppliers of medical equipment and by the national Department of Health and other private companies.

  First semester:

  Bio-Systems I, Digital Systems II, Electronics III, Mathematics III and Medical Equipment II.

  Second semester:

  Control Systems III, Design Project, Digital Systems III, Medical Equipment: Equipment III and Medical Equipment: Systems III.

- **DIGITAL TECHNOLOGY**
  Field description:
  Digital technology is defined as the technology of processing and distributing data, audio and video signals with equipment and in subsystems. It forms the basis of modern computer technology, computer networks, all audio and video equipment and the telecommunications technology. The training programme equips students with a sound scientific background and mathematical skills that enable them to solve engineering problems by designing, implementing and maintaining systems at a technical level. Possible employers are Eskom, Telkom, AEC, Kentron, LEW, SAA, SANW, Siemens, SAMES, SABC and many other smaller electronic companies.

  First semester:
  Digital Systems II, Electronic Communication II, Electronics III, Mathematics III and Software Design III.
  Second semester:
  Control Systems III, Design Project, Digital Systems III, Electronic Communication III and Logic Design III.

- **ELECTRONIC ENGINEERING**
  Field description:
  Electronic engineering deals mainly with the design, implementation and maintenance of electronic systems, using the accumulation of signals at the analogue level from signals and sensors, the amplification of these and the presentation and processing of the data. Appropriate feedback systems may be implemented in order to enhance the performance of systems. The discipline finds application in the audio, video, electronic manufacturing and electronic control fields. The discipline involves sound scientific and mathematical skills at a technical level to solve engineering problems.

  First semester:
  Digital Systems II, Electronic Communication II, Electronics III, Mathematics III and Software Design III.
  Second semester:
  Control Systems III, Design Project, Digital Systems III, Electronic Communication III and Power Electronics III.

- **POWER ENGINEERING**
  Field description:
  Power engineering becomes more advanced in the generation and distribution of power through the use of sophisticated digital and electronically controlled devices. Students who have completed this qualification will be able to understand, evaluate, design, plan, install, repair and maintain electrical power equipment used in the field. Possible employers are manufacturers, Eskom, mines, municipalities and general industrial manufacturers.

  First semester:
  Digital Systems II, Electrical Distribution III, Electrical Engineering III and Electrical Machines II, Mathematics III.
  Second semester:
  Control Systems III, Design Project, Electrical Machines III, Electrical Protection III and Power Electonics III.

- **PROCESS INSTRUMENTATION**
  Field description:
  Process instrumentation becomes more sophisticated every day with the development of digital and electronic components and controlled devices. Students who have completed this qualification will be able to understand, evaluate, design, plan, install, repair and maintain the digital, electrical and electronic equipment used in industry. Possible employers are industrial manufacturers, Eskom, mines and general industrial workplaces.

  First semester:
  Digital Systems II, Electronics III, Mathematics III, Process Instrumentation II and Software Design III.
  Second semester:
  Control Systems III, Design Project, Digital Systems III, Power Electronics III and Process Instrumentation III.

- **TELECOMMUNICATION ENGINEERING**
  Field description:
  Students who have completed their studies will be skilled and competent in the marketing, development and repair of electronic systems for the world market. Students will also be able to design, program, integrate, implement, commission and maintain RF systems, telecommunication, satellite and cellular telecommunication systems. Possible employers are electronic system companies and general electronic application companies that operate in all fields such as Telkom, cell phone companies and telematic design companies.

  First semester:
  Digital Systems II, Electronic Communication II, Electronics III, Mathematics III and Software Design III.
  Second semester:
  Design Project, Electronic Communication III, Microwave Communication III, Radio Engineering III and Television III.

- **OWN CHOICE**
  Students who choose this option must ensure that their subject choices will enable them to do the Baccalaureus Technologiae: Engineering: Electrical, should they wish to.

  Description:
  A student can compile his or her own stream leading to a desired field of specialisation by combining subjects from any of the optional subject choices given above. This will enable students who have completed their studies to be skilled and competent in a stream leading to desired new specialisation fields as required by their industry. Possible employers are companies using cutting-edge technologies, such as electronic system companies, power electronic and power application companies that operate in all electrical engineering fields.

  First semester:
  Digital Systems II, Mathematics III, Electronic III or Electrical Engineering III and two subjects from those provided in the optional subject list for year two, semester one.
  Second semester:
  Design Project and any four subjects from those provided in the optional subject list for year two, semester two.

SUBJECT/MODULE INFORMATION (OVERVIEW OF SYLLABUS)

The syllabus content is subject to change to accommodate industry changes. Please note that a more detailed syllabus is available at the Department or in the study guide that is applicable to a particular subject. On 13 October 2017, the syllabus content was defined as follows:

B

BIO-SYSTEMS I (BIS101T) **1 X 3-HOUR PAPER**
(Subject custodian: Department of Electrical Engineering)
An engineering approach to the human body, with reference to medical terminology and the health care environment. Basic medical terminology. Organ systems: cell structure, movement structures, digestive system, ventilation, control and regulation. Special organ systems (the endocrine system), the thyroid gland. (Total tuition time: ± 70 hours)

C

COMMUNICATION SKILLS (EXTENDED) I (FPCOS03, FPCOSR3) **CONTINUOUS ASSESSMENT**
(Subject custodian: Department of Applied Languages)
Speaking and communication skills, listening skills, reading for academic understanding, academic vocabulary, learning strategies and information gathering, writing, business and life skills. Communication theory. Oral presentation. Technical writing skills. Group communication skills. (Total tuition time: ± 120 hours)

COMPUTER SKILLS (EXTENDED) I (FPCSK02, FPCSKR2) **CONTINUOUS ASSESSMENT**
(Subject custodian: End User Computing Unit)
Students have to acquire theoretical knowledge (computing fundamentals) and practical skills as end-users in operating systems and MS Office Suite applications (MS Word, MS Excel, MS Excel Intermediate, MS PowerPoint, MS Access Essentials and MS Visio Professional), graphic design and dealing with the Internet, networks and how to search for information. Students will do online and computer-based tests. The modules are mapped with SAQA and IC3 Essential Skills for Digital Literacy (international certification). (Total tuition time: ± 80 hours)

CONTROL SYSTEMS III (CSY321T) **1 X 3-HOUR PAPER**
(Subject custodian: Department of Electrical Engineering)
Mathematical modelling of systems, stability of linear feedback systems, steady state error, feedback-control characteristics and the root locus. (Total tuition time: ± 70 hours)

D

DESIGN PROJECT: HEAVY CURRENT III (DPJ30ZT) **CONTINUOUS ASSESSMENT**
(Subject custodian: Department of Electrical Engineering)
This subject covers the concepts and implementation of the design of power engineering systems. This includes the context of power engineering systems and components design (the technology-based organisation), systems engineering concepts (from problem-solving to design implementation), practical implementation, including circuit or system design, construction and documentation. Assessment is through open-book tests, a practical project, a research topic and a final examination. (Total tuition time: ± 70 hours)

DESIGN PROJECT: LIGHT CURRENT III (DPJ30YT) **CONTINUOUS ASSESSMENT**
(Subject custodian: Department of Electrical Engineering)
This subject covers the concepts and implementation of the design of light current systems. This includes the context of electronic, telecommunications, digital technology, medical technology, or control technology systems and components design (the technology-based organisation), systems engineering concepts (from problem-solving to design implementation), practical implementation, including circuit design, construction and documentation. Assessment is through open-book tests, a practical project, a research topic and a final examination. (Total tuition time: ± 70 hours)

DIGITAL SYSTEMS I (DSY131T) **1 X 3-HOUR PAPER**
(Subject custodian: Department of Electrical Engineering)
Basic components of digital circuits, namely NOT, AND and NOR gates. How more complex gates and logic functions can be built from the basic gates. Boolean algebra and Karnaugh maps are used to simplify functions. Combinational logic circuits, including adders, comparators, decoders, encoders, multiplexers, demultiplexers and error control circuits. Binary, octal, decimal and hexadecimal numbers and operations. Basic components of sequential circuits, namely latches and flip-flops. Counters. (Total tuition time: ± 70 hours)

DIGITAL SYSTEMS II (DSY231T) **1 X 3-HOUR PAPER**
(Subject custodian: Department of Electrical Engineering)
How more complex memory components, such as counters and registers, can be built from the basic components. Different analogue-to-digital and digital-to-analogue converters. Introduction to microprocessor systems and programmable interface control devices (PiCs). TTL and CMOS-integrated circuit technologies and electronic display units. Introduction to programmable logic devices (PLD, EPLD, FPGA). (Total tuition time: ± 70 hours)

DIGITAL SYSTEMS III (DSY341T) **1 X 3-HOUR PAPER**
(Subject custodian: Department of Electrical Engineering)
The emphasis is on computer memory and the application of a micro controller. Characteristics of Read-Only Memories (ROM, EPROM, EEPROM, FLASH and RAM). Expansion of memory such as data bus, memory locations (size) and a combination of both. The microcontroller architecture, memory arrangements of the micro controller, interrupts and vector addresses, timers/counters and serial communication as well as the connection and control of peripheral devices such as ADC's, keypads, and LCD displays will be examined. The design and implementation of software and hardware for applications is supported by flow charts, assembly language and C language and forms and important component of the subject. After completion of the subject a student will be able to design and write programs to solve real life problems in industry. (Total tuition time: ± 70 hours)

E

ELECTRICAL ENGINEERING (EXTENDED) I (FPEEN01, FPEENR1) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Module 1: Introduction to engineering, factory safety, measurements, engineering materials, projects. Module 2: Lettering, line work and freehand sketches, geometric constructions, fasteners, dimensioning, methods of projections, sectioning, interpenetration curves and pipe developments, conversions: imperial to metric, terms and abbreviations used in engineering drawing, piping diagrams. The correct use of SI units and their applications, the construction and maintenance of batteries, a network analysis of direct current circuits and AC theory, a study of various measuring instruments. An investigation into the effects of magnetic lines of force, the application and use of magnetic fields, inductance and the factors affecting it, capacitors and their operation. (Total tuition time: ± 140 hours)

ELECTRICAL ENGINEERING II (EEN211T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

The analysis of networks by means of different methods, the effect of harmonics, three-phase systems, power factor correction, the operation of motors and transformers. (Total tuition time: ± 70 hours)

ELECTRICAL ENGINEERING III (EEN311T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Three-phase balanced and unbalanced circuits. Symmetrical components and short-circuit and open-circuit problems. Per-unit and basic fault-current calculations. Power in three-phase systems. Power and energy measurements in three-phase circuits. Illumination. (Total tuition time: ± 70 hours)

ELECTRICAL MACHINES II (EMA241T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Basic and applied knowledge and practical skills in the field of alternating current single-phase transformers and direct current machinery, namely their construction, principle of operation, operational theory, basic control and applications. The performance and applications of the machinery are closely linked with the improvement of their efficiency and general energy saving when applied in an industrial environment. (Total tuition time: ± 70 hours)

ELECTRICAL MACHINES III (EMA341T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Basic and applied knowledge and practical skills in the field of alternating current three-phase and single-phase machinery, namely their construction, principle of operation, operational theory, basic control and applications. The performance and applications of the machinery are closely linked with the improvement of their efficiency and general energy saving when applied in an industrial environment. (Total tuition time: ± 70 hours)

ELECTRONIC COMMUNICATION II (ETC221T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Introduction to communication systems, electromagnetic spectrum. Analysis of passive networks. Transmission lines. Modulation, principles of AM, FM, PM and pulse modulation. Electromagnetic waves and wave propaga-tion. Radio receivers, superheterodyne receivers. Antenna principles. Data communication principles. (Total tuition time: ± 70 hours)

ELECTRONIC COMMUNICATION III (ETC301T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Modulation techniques: ASK, FSK, PSK, QAM, QPSK, CPFSK, MSK, PAM, TDM, Delta, PCM and DPCM, PNH, SDH. Data control and packaging: data interfaces, matched filter, matched filter codeword detection, error detection and correction. Switching systems. Protocols: V11, V35, V24, R5232, X21 and X25. OSI layer presentation packet switching. ATM networks. Electromagnetic theory. (Total tuition time: ± 70 hours)

ELECTRICAL DISTRIBUTION III (ELD331T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

The three major components of a power system: generation, transmission and distribution. Theory and applications: load curves, economics of power generation and tariffs of supply, power factor improvement, power supply systems, design and performance of overhead transmission lines, distribution systems and underground cables. (Total tuition time: ± 70 hours)

ELECTRICAL PROTECTION III (EPC321T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Introduction to electrical protection: main components. Symmetrical faults calculation and methods of limiting fault currents. Principle of operation of circuit breakers, fuses. Principle of operation of relays. Implement protective relaying schemes for alternators and transformers and busbars and lines. (Total tuition time: ± 70 hours)

ELECTRONICS (EXTENDED) I (FPELC01, FPELCR1) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Module 1: Atom theory, electricity, magnetism and electromagnetism, inductors, capacitors, RLC networks. Module 2: Atoms, molecules and ions, chemical formulas and equations, the periodic table, chemical bonding, nomenclature of inorganic compounds, phases of matter, solutions, the rate of chemical reactions, equilibrium in chemical reactions, acids and bases, oxidation, reduction and electrochemical cells. Introduction to electronic components, analysis and design using measuring instruments, diodes and rectification, simple power supplies, DC operating point of single-stage bipolar junction- and field-effect transistor amplifiers and basic operational amplifier configurations. Theory supported by assessed practical experiments in a laboratory, including soldered and proto-board projects. (Total tuition time: ± 140 hours)

ELECTRONICS II (ELC211T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Modelling of electronic components and their application in circuit analysis and design. Unregulated and regulated linear power supplies with transistor and operational amplifier error correction, short-circuit protection and heat sink principles. Small-signal modelling of transistor amplifiers. Theory is supported by assessed project and practical experiments in a laboratory. (Total tuition time: ± 70 hours)

ELECTRONICS III (ELC331T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Analysis and design of analogue electronic subsystems through multistage amplifier modelling, feedback configurations, time and frequency principles in amplifier systems, oscillator circuits, electromagnetic compatibility and electrical noise principles. The student should demonstrate the principles of analogue circuit design and analysis. Assessment is through a demonstrated project and written examination. (Total tuition time: ± 70 hours)

ENGINEERING SCIENCE (EXTENDED) I (FPESL01, FPESLR1) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Physics)

Mathematical concepts, including vectors, mechanics – kinematics in one and two dimensions, Newton's laws of motion, rotational motion, work, energy and power, static and dynamic fluids, heat: temperature and heat, heat transfer, waves and optics – properties of waves and sound, electromagnetic waves, geometric optics: light, reflection, thin lenses, prisms and dispersion, aberration, combined lenses, optical instruments, interference and diffraction. Laser: simple theory, types and applications, practical work. (Total tuition time: ± 140 hours)

L

LOGIC DESIGN III (LOD311T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

The emphasis in this subject is on communication methods (Electrical standard) and communication protocols as well as the use of additional peripherals apart from those studied in Digital Systems II and III. Communication protocols like Modbus, CANbus, and LINbus will be examined and implemented. Inter Interchangeable Communication (I2C), RS 482, RS 232, SPI will be implemented. Peripherals namely UART's, Real Time Clock, ADC's, LCD's, IO port expanders, EEPROM memory connection and implementations and FRAM will be investigated. The implementation of the Watchdog Timer and different interrupts will be examined. The design and implementation of software and hardware for applications is supported by flow charts and embedded language programs. After completion of the subject a student will be able to solve real life problems in industry. (Total tuition time: ± 70 hours)

M

MATHEMATICS (EXTENDED) I (FPMAT04, FPMATR4) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Mathematics and Statistics)

Basic algebra, functions, exponents and logarithm, differential calculus, trigonometry, geometry. Basic mathematics. Differentiation. Integration. Matrices and determinants. Vectors. Data handling. Complex numbers or mensuration. (Total tuition time: ± 120 hours)

MATHEMATICS II (MAT271B) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Mathematics and Statistics)

Revision of differentiation. Differentiation of functions with more than one variable. Further integration. Numerical methods. First-order ordinary differential equations. Matrices (Gauss elimination). (Total tuition time: ± 60 hours)

MATHEMATICS III (MAT351T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Mathematics and Statistics)

First-order differential equations. Higher-order differential equations. Basic mathematical modelling. Laplace transforms. Systems of differential equations. Numerical solutions of differential equations. Fourier Series. (Total tuition time: ± 70 hours)

MEDICAL EQUIPMENT II (MEQ211T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Introduction to electrodes, sensors, transducers and bio-amplifiers used in medical equipment and medical systems: types of measurements, common sensors and transducers, instrumentation amplifier, bio-signals and amplifiers and classification of biomedical instrumentations. (Total tuition time: ± 70 hours)

MEDICAL EQUIPMENT: EQUIPMENT III (MEQ33XT) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Introduction to transducers, detectors and sensors, diagnostic equipment and systems: thermometers, blood pressure measurement, electrocardiography, electro-encephalography, electromyography, lung function and spirometry, cardiac output monitoring, specialised systems, therapeutic equipment and systems: infusion pumps, dialysis machines, ventilation. (Total tuition time: ± 70 hours)

MEDICAL EQUIPMENT: SYSTEMS III (MEQ33YT) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Electrical safety of medical equipment and systems, testing for performance of systems and fault-finding. Non-ionising radiation: production and detection, introduction to clinical engineering management. (Total tuition time: ± 70 hours)

MICROWAVE COMMUNICATION III (MWC301T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Maxwell equations, electrical model of a transmission line, response of lines, wave propagation on lines, transmission line losses, impedance matching, and transmission line measurements. Microwave devices-waveguides, passive components, microwave solid state devices, microwave tubes and microwave antennas. Radio wave propagation: ground wave, ionospheric and line-of-sight propagation, terrestrial microwave communication. (Total tuition time: ± 70 hours)

P

POWER ELECTRONICS III (PWE311T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Principles of power semiconductor devices. Single-phase rectifiers, basic principles of DC choppers, basic control of inverters, AC voltage controllers and single-phase supplied DC drives. Design principles to protect semiconductor components against overvoltage, overcurrent, overheat, too high dV/dt and dI/dt and also ways to implement them in series and parallel. (Total tuition time: ± 70 hours)

PROCESS INSTRUMENTATION II (PCM221T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

This subject teaches students the required knowledge and skills to understand and apply the basic principles of all the different types of sensors and instruments for process control (flow, temperature, pressure and level), Electronic detectors, transmitters, actuators and their applications and PLC control systems. The knowledge and skills are required to define, design, construct, commission and maintain a process control system. (Total tuition time: ± 70 hours)

PROCESS INSTRUMENTATION III (PCM321T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

The use of measuring instruments, valves, pumps, tanks, piping, vessels, turbines and motors in various plant operations and systems. Process control diagrams, control strategies and operation of plant units for boilers, heat exchangers, furnaces, cooling towers, and distillation systems. Instrumentation for hazardous environments. (Total tuition time: ± 70 hours)

R

RADIO ENGINEERING III (RAE311T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Radio frequency amplifiers. Amplitude and angle modulation, as well as demodulation. Frequency conversion and mixing. Receivers. Basic antenna theory and practical antennae. (Total tuition time: ± 70 hours)

S

SOFTWARE DESIGN II (SFD201T) **CONTINUOUS ASSESSMENT**

(Subject custodian: Department of Electrical Engineering)

Developing and applying structured programming. The core outcomes focus on basic C programming. This includes basic input/output, conditional execution, statement repetition, functions, libraries and one- dimensional arrays. The subject is very practical, and assessment is based on a number of programming tasks and/or tests completed during the semester. (Total tuition time: ± 70 hours)

SOFTWARE DESIGN III (SFD301T) **CONTINUOUS ASSESSMENT**

(Subject custodian: Department of Electrical Engineering)

The emphasis is on applications of embedded C language programming for microcontrollers. Memories (ROM, EPROM, EEPROM, FLASH, RAM and NVRAM) as used with a microcontroller will be explained. The microcontroller architecture, memory arrangements, interrupts, timers and serial communication as well as peripheral devices such as ADC's, keypads, and LCD displays will be examined and implemented. The design and implementation of software and hardware for applications is supported by flow charts and C language and forms an important component of the subject. Structured C programming will be taught, developed and applied. This includes basic input/output, conditional execution, statement repetition, functions and libraries. After completion of the subject a student will be able to solve real life problems in industry. Students will be expected to solve home problems and exercises in order to master the subject. (Total tuition time: ± 70 hours)

T

TELEVISION III (TLV311T) **1 X 3-HOUR PAPER**

(Subject custodian: Department of Electrical Engineering)

Fundamentals of television: Light theory and colometry, formation of picture raster, composite video signal, RF television channel. Cameras: CCD and Plumbicon camera tube. Colour signal. Television receivers, displays: CRT, LCD, PLASMA, LED, distortion, block diagrams, television circuits analysis. Measurements. (Total tuition time: ± 70 hours)

W

WORK-INTEGRATED LEARNING: PRACTICE I (EXP1EYT) **WORK-INTEGRATED LEARNING**

(Subject custodian: Department of Electrical Engineering)

Industry-related training, as determined by the industry and the University. (Total tuition time: six months)

WORK-INTEGRATED LEARNING: WORKSHOP I (EXP1EWT) **WORK-INTEGRATED LEARNING**

(Subject custodian: Department of Electrical Engineering)

The aim is to provide the student with the required skills and knowhow to do work-integrated training. This include the following: Safety and first aid. Application of hand tools, power tools and equipment in practical work. Planning, designing marking and building of containers/boxes using sheet-metal work. Reading and understanding of basic schematic diagrams. Wiring techniques as used in houses, panels and electrical systems. Proteus software design package, soldering tools and techniques, measuring instruments and techniques. The planning, design, layout, construction, faultfinding, testing, documentation and presentation of a complete project. (Total tuition time: ± 70 hours)

WORK-INTEGRATED LEARNING II (EXP2EEH) **WORK-INTEGRATED LEARNING**

(Subject custodian: Department of Electrical Engineering)

Industry-related training, as determined by the industry and the University. (Total tuition time: six months)