DIPLOMA IN ELECTRICAL ENGINEERING

Dip (Electrical Engineering) - NQF Level 6 (360 credits)

Qualification code: DPEE20

SAQA ID: 100953, CHE NUMBER: H16/14240/HEQSF

Campus where offered: Pretoria and eMalahleni campuses

REMARKS

a. Admission requirement(s) and selection criteria:

- **FOR PPLICANTS WITH A SENIOR CERTIFICATE OBTAINED BEFORE 2008:**

  Admission requirement(s):
  A Senior Certificate or an equivalent qualification, with a C symbol at Standard Grade or a D symbol at Higher Grade for English, Mathematics and Physical Science.

  Recommended subject(s):
  None.

  Selection criteria:
  To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least **26**.

- **FOR PPLICANTS WITH A NATIONAL SENIOR CERTIFICATE OBTAINED IN OR AFTER 2008:**

  Admission requirement(s):
  A National Senior Certificate or an equivalent qualification, 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 or Technical Mathematics, and 4 for Physical Sciences or Technical Sciences.

  Recommended subject(s):
  Electrical Technology and Engineering Graphics and Design.

  Selection criteria:
  To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least **26** (excluding Life Orientation).

- **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 a 50% (APS of 4) for English, 50% for Life Orientation (excluded for APS calculation), and 60% (APS of 5) for Mathematics and Science, and 50% (APS of 4) for any two compulsory vocational subjects.

  Recommended subject(s):
  Electrical Principles and Practice, Electrical Systems and Construction Electrical Workmanship, Electronic Control and Digital Electronics.

  Selection criteria:
  To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least **26** (excluding Life Orientation).

- **FOR APPLICANTS WITH A NATIONAL N CERTIFICATE/NATIONAL SENIOR CERTIFICATE AS PUBLISHED IN REPORT 191: N3 (NQF LEVEL 4):**

  Admission requirement(s):
  A National Senior Certificate or a National N Certificate with languages as published in Report 191: N3 (NQF Level 4) issued by both the Department of Higher Education and Training (DHET) and the Council for Quality Assurance in General and Further Education and Training (Umalusi), with at least 50% (APS of 4) for English, Mathematics N3, Engineering Sciences N3 and any other two additional subjects.

  Recommended subject(s):
  Electrical Trade Theory, Electro Technology, Engineering Drawing and Industrial Electronics.

- **FOR PPLICANTS WITH AN N6 CERTIFICATE IN A RELATED ENGINEERING FIELD AS PUBLISHED IN REPORT 191: N4:**

  Admission requirement(s):
  An N6 Certificate in a related Engineering field as published in Report 191: N6 issued by both the Department of Higher Education and Training (DHET) and the Council for Quality Assurance in General and Further Education and Training (Umalusi), with an average of at least 60% for the qualification, and successful completion of an English Language Proficiency Assessment (done by the University).

  Recommended subject(s):
  None.

- **FOR APPLICANTS WITH QUALIFICATIONS ON THE HIGHER EDUCATION QUALIFICATION SUB-FRAMEWORK (HEQSF) OFFERED BY UNIVERSITIES OF TECHNOLOGY:**

  The applicant will be considered for admission to the programme, if any of the following qualifications has been completed:

  - Higher Certificate in Electrical Engineering (NQF Level 5 - 140 credits).
  - Advanced Certificate in Electrical Engineering (NQF Level 6 - 140 credits).

b. *Assessment procedure(s):*
No further assessment will be done (except for candidates with an N6 Certificate (see above)). Applicants who achieve the minimum APS will be considered until the programme complement is full. Acceptance is subject to available capacity according to the Student Enrolment Plan (SEP). Once a programme is full, a waiting list will be in place to provide an opportunity for applicants to fill places of those who did not register on time. Applicants will be informed of their status per official letter from the Office of the Registrar, alternatively, they can check their application status on the TUT website, www.tut.ac.za.

Applicants who do not meet the minimum requirements, might be transferred to the Higher Certificate in Electrical Engineering, provided that he/she meets the minimum requirements.

c. *Recognition of Prior Learning (RPL), equivalence and status:*
See Chapter 30 of Students' Rules and Regulations.

d. *Intake for the qualification:*
January and July.

e. *Presentation:*
Day classes.

f. *Minimum duration:*
Three years.

g. *Exclusion and readmission:*
See Chapter 2 of Students' Rules and Regulations.

h. *Experiential Learning I (Work-Integrated Learning):*
See Chapter 5 of Students' Rules and Regulations.

CURRICULUM

FIRST YEAR

CODE	MODULE	NQF-L	CREDIT	PREREQUISITE MODULE(S)
FIRST SEMESTER				
COL115X	Computer Literacy	(5)	(5)	
COS115X	Communication Skills	(5)	(5)	
DSA115D	Digital Systems IA	(5)	(12)	
EEA115D	Electrical Engineering IA	(5)	(12)	
ETA115D	Electronics IA	(5)	(12)	
LFS125X	Life Skills (block module)	(5)	(2)	
MHA115D	Mathematics IA	(5)	(12)	
TOTAL CREDITS FOR THE SEMESTER:			60	
SECOND SEMESTER				
EEB115D	Electrical Engineering IB	(5)	(12)	Electrical Engineering IA
ETB115D	Electronics IB	(5)	(12)	Electronics IA
MEC115D	Mechanics	(5)	(12)	
MHB115D	Mathematics IB	(5)	(12)	Mathematics IA
SFD115D	Software Design	(5)	(12)	Computer Literacy
TOTAL CREDITS FOR THE SEMESTER:			60	
TOTAL CREDITS FOR THE FIRST YEAR:			**120**	

SECOND YEAR

Modules must be taken in the combinations and in the sequence indicated. The following rule will apply:

- Electrical Engineering II and Workshop Practice must be taken concurrently, or Electrical Engineering II should be completed before a student will be permitted to register for Workshop Practice.

CODE	MODULE	NQF-L	CREDIT	PREREQUISITE MODULE(S)
FIRST SEMESTER				
DSB215D	Digital Systems IB	(5)	(12)	Digital Systems IA
EGT216D	Engineering Management	(6)	(12)	
ELE216D	Electrical Engineering II	(6)	(12)	Electrical Engineering IB
MAT216D	Mathematics II	(6)	(12)	Mathematics IB
WSP215D	Workshop Practice	(5)	(12)	
TOTAL CREDITS FOR THE SEMESTER:			60	
SECOND SEMESTER				
AUT216D	Automation	(6)	(12)	Software Design
CNS216D	Control Systems	(6)	(12)	Mathematics II
EMH216D	Electrical Machines	(6)	(12)	Electrical Engineering II

PJT215D	Projects	(5)	(12)	Digital Systems IB Electrical Engineering II Electronics IB

plus one of the following specialisation electives:

CLE216D	Clinical Engineering I	(6)	(12)	Electronics IB
EAP216D	Electronic Application I	(6)	(12)	Electronics IB
EBS216D	Embedded Systems I	(6)	(12)	Digital Systems IB
ECM216D	Electronic Communication I	(6)	(12)	Electronics IB
PCI216D	Process Instrumentation I	(6)	(12)	Mechanics
PWS216D	Power Systems I	(6)	(12)	Electrical Engineering II

TOTAL CREDITS FOR THE SEMESTER: 60

TOTAL CREDITS FOR THE SECOND YEAR: **120**

THIRD YEAR

Modules must be taken in the combinations and in the sequence indicated. The following rule will apply:

- Specialisation modules must be taken concurrently with the Design Projects or the specialisation modules should be passed before a student will be permitted to register for Design Projects.

CODE	MODULE	NQF-L	CREDIT	PREREQUISITE MODULE(S)
FIRST SEMESTER				
DPE316D	Design Projects	(6)	(12)	Projects
PWE316D	Power Electronics	(6)	(12)	Control Systems
REN316D	Renewable Energy	(6)	(12)	Electrical Engineering II

plus one of the following specialisation electives:

CLE316D	Clinical Engineering II	(6)	(24)	Clinical Engineering I
EAP316D	Electronic Application II	(6)	(24)	Electronic Application I
EBS316D	Embedded Systems II	(6)	(24)	Embedded Systems I
ECM316D	Electronic Communication II	(6)	(24)	Electronic Communication I
PCI316D	Process Instrumentation II	(6)	(24)	Process Instrumentation I
PWS316D	Power Systems II	(6)	(24)	Power Systems I
SECOND SEMESTER				
WEE316D	Experiential Learning	(6)	(60)	Design Projects

TOTAL CREDITS FOR THE THIRD YEAR: **120**

TOTAL CREDITS FOR THE QUALIFICATION: **360**

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 module. At time of publication, the syllabus content was defined as follows:

A

AUTOMATION (AUT216D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Flow sheet symbols and functional diagramming for process instrumentation diagrams; Measurement; Manipulation; Hierarchical control; Programmable logic controllers (PLC); Distributed control systems (DCS); Supervisory control and data acquisition (SCADA); and an introduction to networks in process automation. (Total notional time: 120 hours)

C

CLINICAL ENGINEERING I (CLE216D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Knowledge and understanding of the basic concept of Anatomy and Physiology as it relates to the Levels of Organisation of the human body. Knowledge and understanding of the organ systems responsible for support and movement, integration and coordination, transport and immunity and absorption and excretion in the human body.(Total notional time: 120 hours)

CLINICAL ENGINEERING II (CLE316D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Safety in the medical environment. Performance of systems and fault finding. Operational procedure for a workshop. Ionising radiation: Production and detection. Non-ionizing radiation: Production and detection. Medical Equipment. (Total notional time: 240 hours)

COMMUNICATION SKILLS (COS115X) **1 X 2-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

The purpose of this module is to identify and apply basic competencies related to communicating in a technical or engineering environment. These competencies include presenting technical information to a variety of audiences, preparing technical reports, participating constructively in formal meetings and preparing a variety of business and technical documents. (Total notional time: 50 hours)

COMPUTER LITERACY (COL115X) **CONTINUOUS ASSESSMENT**

(Module custodian: End User Computing Unit)

This module provides foundational knowledge in computing fundamentals, essential digital skills in key applications based on MS Office Suite and network basics (i.e. MS Outlook and Internet). Online exams are mapped with End-User Computing: SAQA 49077 (61591) Core Element as well as Internet and Computing Core Certification. (IC3). (Total notional time: 50 hours)

CONTROL SYSTEMS (CNS216D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Control system basics; modelling in the frequency domain; time response; reduction of multiple subsystems; stability; steady state errors; root locus techniques; frequency response techniques. (Total notional time: 120 hours)

D

DESIGN PROJECTS (DPE316D) **PROJECT ASSESSMENT**

(Module custodian: Department of Electrical Engineering)

This module covers the concepts and implementation of the design of electrical engineering systems. This includes the context of electrical engineering technology systems design (the technology-based organisation), systems engineering concepts (from problem solving to design implementation), and practical implementation, including circuit design, construction and documentation. Assessment is through open-book tests, a research topic, practical project and a final presentation. (Total notional time: 120 hours)

DIGITAL SYSTEMS IA (DSA115D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Introductory digital concepts; Number systems (Decimal, Binary, Hexadecimal, and Octal); Logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR), Boolean Algebra, Karnaugh Maps, Design Techniques and Code Converters; Combinational Logic: Adders, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders. Use of Data Sheets in application environment. (Total notional time: 120 hours)

DIGITAL SYSTEMS IB (DSB215D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Basic components of sequential circuits, namely latches and flip-flops. How more complex memory components, such as counters (Asynchronous, Synchronous and UP/DOWN) and registers, can be built from the basic components. Different analogue-to-digital and digital-to-analogue converters. TTL and CMOS-integrated circuit technologies, multi-vibrators and electronic display units. Introduction to programmable logic devices (PLD). Use of RAM memories in digital applications. Use of sata sheets in an application environment. (Total notional time: 120 hours)

E

ELECTRICAL ENGINEERING IA (EEA115D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Basic Electrical Technology (DC); Electrical Circuits (DC); Electrostatics (DC); Magnetism and electromagnetism; Alternating Current Theory; and Alternating Current Circuits; Electrical System Networks. (Total notional time: 120 hours)

ELECTRICAL ENGINEERING IB (EEB115D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Single-Phase AC Circuits; Power in AC Circuits; DC and AC Circuit Analysis; Harmonics; Three Phase System; Single Phase and Three Phase Transformers. (Total notional time: 120 hours)

ELECTRICAL ENGINEERING II (ELE216D) **1 X 3-HOUR PAPER**

(Module 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 notional time: 120 hours)

ELECTRICAL MACHINES (EMH216D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Electromechanical Energy Conversion Principles and Laws; DC Machines; Induction Motors; Synchronous Machines; Electric Motor and Drive Selection, and Sizing and Applications. (Total notional time: 120 hours)

ELECTRONIC APPLICATION I (EAP216D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

BJT amplifier design; MOSFET amplifier design; Multistage amplifiers; Differential amplifiers; Power amplifiers and output stages; Feedback networks; Amplifier frequency response; Op-amp limitations and non-ideal op-amps; Feedback oscillators; Relaxation oscillators and multi-vibrators. (Total notional time: 120 hours)

ELECTRONIC APPLICATION II (EAP316D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Practical transducer circuits; Operational amplifier circuits; Analog multipliers; Active filters; Signal generators; Reference circuits; Sample electronics; Communication electronics; Switch-mode supplies. (Total notional time: 240 hours)

ELECTRONIC COMMUNICATION I (ECM216D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Introduction to Communication Systems. Amplitude Modulation (Transmission and Reception). Frequency Modulation (Transmission and Reception). Transmission Lines. Radio Wave Propagation and Antennas. Communication Technologies. (Total notional time: 120 hours)

ELECTRONIC COMMUNICATION II (ECM316D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

This module covers modern electronic communication areas with intensive hands-on skills on the use of emerging electronic communication tools such as SDR techniques. The contents are namely, Introduction to Software-Defined Radio (SDR) Techniques; Digital Communication Fundamentals; Code Error Detection and Correction; Wired Digital Communications; Wireless Digital Communications; Antennas; Introduction to Communication Networks and Protocols; and Projects in Application Areas such as Digital Television, Radio and Microwave Communication Systems. (Total notional time: 240 hours)

ELECTRONICS IA (ETA115D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Passive and active components, Diodes and special diodes; Power supply construction; Bipolar junction transistors; Field effect transistors; Introduction to signal analysis. (Total notional time: 120 hours)

ELECTRONICS IB (ETB115D) **1 X 3-HOUR PAPER**

(Module 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 notional time: 120 hours)

EMBEDDED SYSTEMS I (EBS216D) **1 X 3-HOUR PAPER**

(Module 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 micro-controller 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 ADCs, 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 an important component of the module. After completion of the module, a student will be able to design and write programs to solve real life problems in industry. (Total notional time: 120 hours)

EMBEDDED SYSTEMS II (EBS316D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

The emphasis in this module is on communication methods (Electrical standard) and communication protocols as well as the use of additional peripherals apart from those studied in Embedded Systems I. Communication protocols like Modbus will be examined and implemented. Inter-Integrated Communication (I2C), RS 422, RS 485, RS 232, RS 423 and SPI will be implemented. Peripherals namely UART's, Real Time Clock, ADCs, LCDs, IO port expanders, EEPROM memory connection and implementations will be investigated. The implementation of 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 module, a student will be able to solve real life problems in industry using the relevant hardware, as well as flow charts and embedded language programs. (Total notional time: 240 hours)

ENGINEERING MANAGEMENT (EGT216D) **CONTINUOUS ASSESSMENT**

(Module custodian: Department of Electrical Engineering)

The Environment in which Technical People Work; Principles of General Management; Human Resource Management; The Impact of Employment Relations and Labour Legislation on an Organisation; Managing People and Teams; Total Quality Management; An Introduction to Safety Management; The Engineer, user of Information and Communication Systems; Entrepreneurship; Ethics for Engineering Professionals. (Total notional time: 120 hours)

EXPERIENTIAL LEARNING (WEE316D) **WORK-INTEGRATED LEARNING**

(Module custodian: Department of Electrical Engineering)

Industry-related training, as determined by the industry and the University. (Total notional time: 600 hours)

L

LIFE SKILLS (LFS125X) **CONTINUOUS ASSESSMENT**

(Module custodian: Directorate of Student Development and Support)

Personal, socio-emotional and academic skills development for students in higher education. This module includes: 1. Intra- and interpersonal skills (e.g. emotional intelligence, relationships, and conflict management); 2. General study skills (e.g. time management, goal setting, learning styles); 3. Health and wellness (e.g. HIV/AIDS, GBV issues, substance abuse); 4. Student life and adjustment (e.g. identity development, adjusting to a higher education environment); and 5. Financial management. (Total notional time: 20 hours)

M

MATHEMATICS IA (MHA115D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Mathematics and Statistics)

Basic mathematics. Differentiation. Integration. Matrices and determinants. Vectors. Data handling. (Total notional time: 120 hours)

MATHEMATICS IB (MHB115D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Mathematics and Statistics)

Complex numbers, Revision of differentiation. Differentiation of functions with more than one variable. Further integration. Numerical methods. First-order ordinary differential equations. Matrices (Gauss elimination). (Total notional time: 120 hours)

MATHEMATICS II (MAT216D) **1 X 3-HOUR PAPER**

(Module 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 notional time: 120 hours)

MECHANICS (MEC115D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Mechanical and Mechatronics Engineering)

Moments, centroids, kinematics, forces and Newton's laws, momentum and impulse, work and energy, circular motion, statics. (Total notional time: 120 hours)

P

POWER ELECTRONICS (PWE316D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Operation and limitations of power semiconductor devices and basic methods to prevent the failure. AC Voltage controllers. Single-phase and three-phase uncontrolled rectifiers. Power conversion single-phase and three-phase inverters with PWM (DC-to-AC power conversion). Basic DC-to-DC power conversion. (Total notional time: 120 hours)

POWER SYSTEMS I (PWS216D) **1 X 3-HOUR PAPER**

(Module 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 notional time: 120 hours)

POWER SYSTEMS II (PWS316D) **1 X 3-HOUR PAPER**

(Module 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 notional time: 240 hours)

PROCESS INSTRUMENTATION I (PCI216D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

This module 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, 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 notional time: 120 hours)

PROCESS INSTRUMENTATION II (PCI316D) **1 X 3-HOUR PAPER**

(Module 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 notional time: 240 hours)

PROJECTS (PJT215D) **CONTINUOUS ASSESSMENT**

(Module custodian: Department of Electrical Engineering)

Group applications projects: research, building (planning, design, layout), construction, testing, documentation and oral presentation of complete projects. (Total notional time: 120 hours)

R

RENEWABLE ENERGY (REN316D) **1 X 3-HOUR PAPER**

(Module custodian: Department of Electrical Engineering)

Fundamentals on Energy Conversion; Solar (Photovoltaic) Energy Conversion; Hydro Power Conversion; Wind Energy Conversion Systems; Energy Storage. (Total notional time: 120 hours)

S

SOFTWARE DESIGN (SFD115D) **CONTINUOUS ASSESSMENT**

(Module 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 module is very practical, and assessment is based on a number of programming tasks and/or tests completed during the semester. (Total notional time: 120 hours)

W

WORK PRACTICE (WSP215D) **CONTINUOUS ASSESSMENT**

(Module custodian: Department of Electrical Engineering)

Practical application of electrical engineering concepts as in single- three-phase applications which includes various machine starting methods, rotor testing, transformer tests, distribution board layout and wiring and basic house wiring techniques. (Total notional time: 120 hours)