

# BACHELOR OF ENGINEERING TECHNOLOGY IN ELECTRICAL ENGINEERING

Qualification code: BPEE19 - NQF Level 7 (420 credits)

SAQA ID: 101903, CHE NUMBER: H/H16/E022CAN

Campus where offered:

Pretoria and eMalahleni campuses

## REMARKS

a. *Admission requirement(s) and selection criteria:*

• **APPLICANTS WITH A SENIOR CERTIFICATE OBTAINED BEFORE 2008:**

**Admission requirement(s):**

A Senior Certificate with a matriculation endorsement or an equivalent qualification, with a C symbol at Standard Grade or a D symbol at Higher Grade for English, and B symbols at Standard Grade or C symbols at Higher Grade for Mathematics and Physical Science.

**Selection criteria:**

To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least **30**.

**Recommended subject(s):**

None.

• **APPLICANTS 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 endorsement, or an equivalent qualification, with an achievement level of at least 4 for English (home language or first additional language) and 5 for Mathematics or Technical Mathematics, 5 for Physical Sciences or Technical Sciences and at least 4 for any three additional subjects.

**Selection criteria:**

To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least **30** (excluding Life Orientation).

**Recommended subjects:**

Engineering Graphics and Design and Electrical Technology.

• **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 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 60% (APS of 5) for any other three compulsory vocational subjects.

**Selection criteria:**

To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least **28** (excluding Life Orientation).

**Recommended subject(s):**

None.



- **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% for English, Mathematics N3, Engineering Sciences N3 and any other two additional subjects.

**Selection criteria:**

To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least **28**.

**Recommended subject(s):**

None.

- **APPLICANTS WITH A N6 CERTIFICATE IN A RELATED ENGINEERING FIELD AS PUBLISHED IN REPORT 191: N6:**

**Admission requirement(s):**

A 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.

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

Please note that admission will be based on academic performance; availability of space; and an interview.

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): with an average of at least 60% for the qualification, and 60% in each of the following modules: Electrical Technology, Electronic Technology, Digital Technology, Physics, Technical Mathematics and the chosen elective(s).
- Advanced Certificate in Electrical Engineering (NQF Level 6 - 140 credits): with an average of at least 60% for the qualification.
- Diploma in Electrical Engineering Technology (NQF Level 6 - 280 credits): with an average of at least 60% for the qualification.
- Diploma in Electrical Engineering (NQF Level 6 - 360 credits).
- National Diploma: Engineering: Electrical (NQF Level 6 - 3,000 credits).

*b. Assessment Procedure:*

No further assessment will be done (except for candidates with a N4 Certificate). Applicants who achieve the minimum APS will be considered until the programme complement is full. All completed applications received within the published due dates will be ranked. After consideration of the Departmental Student Enrolment Plan, only the top ranking applicants will be selected. 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](http://www.tut.ac.za).



Applicants who do not meet the minimum requirements, might be transferred to the Higher Certificate or Diploma 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 only.
- e. *Minimum duration:*  
Three years.
- f. *Presentation:*  
Day classes.
- g. *Exclusion and readmission:*  
See Chapter 2 of Students' Rules and Regulations.

## CURRICULUM

### FIRST YEAR

CODE	MODULE	NQF-L	CREDIT	PREREQUISITE MODULE(S)
1EM105B	Mechanics	(5)	(10)	
COL105X	Computer Literacy	(5)	(5)	
COS105X	Communication Skills	(5)	(6)	
EGE105B	Engineering Graphics	(5)	(14)	
ELC105B	Electrical Circuits	(5)	(28)	
ELS105B	Electronic Circuits	(5)	(28)	
EMA105B	Engineering Mathematics I	(5)	(28)	
INL125C	Information Literacy (block module)	(5)	(1)	
LFS125X	Life Skills (block module)	(5)	(2)	

#### FIRST SEMESTER

SEP115B Physics (5) (10)

#### SECOND SEMESTER

SEC115B Chemistry (5) (8)

TOTAL CREDITS FOR THE FIRST YEAR: **140**

### SECOND YEAR

CODE	MODULE	NQF-L	CREDIT	PREREQUISITE MODULE(S)
EBS206B	Embedded Systems	(6)	(28)	Electronic Circuits
EMA206B	Engineering Mathematics II	(6)	(14)	Engineering Mathematics I
ESG206B	Engineering Software Design	(6)	(28)	Computer Literacy
PAS206B	Probability and Statistics	(6)	(14)	Engineering Mathematics I

#### FIRST SEMESTER

AUT216B Automation (6) (14) Computer Literacy  
 CVS216B Conversion Systems (6) (14) Electrical Circuits  
 Engineering Mathematics I



## SECOND SEMESTER

EFW216B	Electromagnetic Fields and Waves	(6)	(14)	Engineering Mathematics I Physics
GES216B	Green Energy Systems	(6)	(14)	Electrical Circuits
TOTAL CREDITS FOR THE SECOND YEAR:			<b>140</b>	

## THIRD YEAR

CODE	MODULE	NQF-L	CREDIT	PREREQUISITE MODULE(S)
ACS307B	Advanced Conversion Systems	(7)	(28)	Conversion Systems
CNS307B	Control Systems	(7)	(28)	Engineering Mathematics II
PWS307B	Power Systems	(7)	(28)	Conversion Systems
SPR307B	Signal Processing	(7)	(28)	Engineering Mathematics II

## FIRST SEMESTER

AES317B	Advanced Embedded Systems	(7)	(14)	Embedded Systems
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## SECOND SEMESTER

EPR317B	Engineering Practice	(7)	(14)	
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TOTAL CREDITS FOR THE THIRD YEAR: **140**

TOTAL CREDITS FOR THE QUALIFICATION: **420**

## 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

#### ADVANCED CONVERSION SYSTEMS (ACS307B)

#### CONTINUOUS ASSESSMENT

*(Module custodian: Department of Electrical Engineering)*

Single-Phase Induction Motors. Three-Phase Induction Machines. Three-Phase Synchronous Machines. Power Electronic Components. Introduction to Power Electronics Converters. (Total tuition time: ± 180 hours)

#### ADVANCED EMBEDDED SYSTEMS (AES317B)

#### CONTINUOUS ASSESSMENT

*(Module custodian: Department of Electrical Engineering)*

8-bit AVR Microcontroller and High-level Programming; Serial Interface Electrical Standards (RS232, RS422 and RS485); Digital Serial Communications Protocols (FIELBUS, Ethernet and USB); Synchronous Serial Communication Protocols (SPI and I2C); RF Modules Attached to USART (Bluetooth and Others); External Peripherals (RTCC, EEPROM, FRAM and DMA Controller). (Total tuition time: ± 140 hours)

#### AUTOMATION (AUT216B)

#### 1 X 3-HOUR PAPER

*(Module custodian: Department of Electrical Engineering)*

Flow-sheet symbols and functional diagramming for process instrumentation diagrams. Measurements; Manipulation; Hierarchical control; Programmable logic controllers (PLC); Distributed control systems (DCS); Supervisory control and data acquisition (SCADA); an introduction to networks in process automation. (Total tuition time: ± 140 hours)



**C****CHEMISTRY (SEC115B)****1 X 2-HOUR PAPER****(Module custodian: Department of Chemistry)**

The Language Chemistry and Matter consists of Particles; The Atom; The Elements and the Periodic Table; Ionic and Molecular Compounds; Chemical equations and stoichiometric calculations; Redox reactions and electricity. (Total tuition time:  $\pm 60$  hours)

**COMMUNICATION SKILLS (COS105X)****1 X 2-HOUR PAPER****(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

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 tuition time:  $\pm 40$  hours)

**COMPUTER LITERACY (COL105X)****CONTINUOUS ASSESSMENT****(Module custodian: End User Computing Unit)**

Students have to acquire foundational knowledge in Computing Fundamentals, essential digital skills in key applications based on Ms Office Suite (i.e. MS Word, MS Excel, MS PowerPoint, MS Visio Professional and MS Access) and network basics (i.e. MS Outlook and Internet). A complete syllabus and module outlines are described in the study guide. Students will do online exams that are mapped with SAQA and IC3 Essential Skills for Digital Literacy (International Certification). (Total tuition time: not available)

**CONTROL SYSTEMS (CNS307B)****1 X 3-HOUR PAPER****(Module custodian: Department of Electrical Engineering)**

Introduction to Control Systems; Modelling in the frequency domain; Modelling in the time domain; Time response; Reduction of Multiple sub-systems; Stability; Steady State Errors; Root Locus Techniques and Design via Root Locus; Frequency Response and Design via Frequency Response; Digital Control systems; Practical work and Project. (Total tuition time:  $\pm 280$  hours)

**CONVERSION SYSTEMS (CVS216B)****1 X 3-HOUR PAPER****(Module custodian: Department of Electrical Engineering)**

Magnetic Circuits. Single-Phase Transformers. Three-Phase Transformers. DC Machines. (Total tuition time:  $\pm 140$  hours)

**E****ELECTRICAL CIRCUITS (ELC105B)****1 X 3-HOUR PAPER****(Module custodian: Department of Electrical Engineering)**

Direct current circuits. Magnetism and electromagnetism. Single phase alternating current systems. Active components in electric circuits. Alternating current with passive and active components in electric circuits. Three-phase alternating current systems. (Total tuition time:  $\pm 280$  hours)

**ELECTROMAGNETIC FIELDS AND WAVES (EFW216B)****1 X 3-HOUR PAPER****(Module custodian: Department of Electrical Engineering)**

Introduction. Electric and Magnetic Fields. Transmission Lines. Wave Propagation. Project–electromagnetic systems. (Total tuition time:  $\pm 140$  hours)

**ELECTRONIC CIRCUITS (ELS105B)****1 X 3-HOUR PAPER****(Module custodian: Department of Electrical Engineering)**

Identification of electronic components. Basic circuit calculations. Understanding of different electrical signals use. Electrical measurements using the laboratory equipment. Conduction in semiconductors and analysis, design and building of basic power supply circuits. Current flow in transistors and analysis, design and building of single transistor circuits. Design and building of practical op-amp application circuits. Design, analysis and building of practical power supplies. Analysis, design and building of different small signal amplifiers configurations. (Total tuition time: not available)



**EMBEDDED SYSTEMS (EBS206B)****1 X 3-HOUR PAPER****(Module custodian: Department of Electrical Engineering)**

Introduction to digital concepts. Number systems (Decimal, Binary, Hexadecimal, Octal). Logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR), Boolean Algebra, Karnaugh Maps, Design Techniques and Code Converters. Combinational Logic: Adders, Comparators, Multiplexers, De-multiplexers, Encoders, Decoders, Code converters. Latches and Flip-Flops, Shift registers, 555 Timers. Asynchronous and Synchronous counters. Peripheral devices (ADC, DAC, I/O port expanders, LCDs, 7/ 14 / 16-Segment displays, Dot-matrix displays, Keypads, EEPROM, RAM). Computer Concepts and micro-controllers (Architecture of 8-bit micro-controllers, programming, flowcharts, Interrupts, Timers and Counters, Serial communication). (Total tuition time: ± 280 hours)

**ENGINEERING GRAPHICS (EGE105B)****CONTINUOUS ASSESSMENT****(Module custodian: Department of Mechanical and Mechatronics Engineering)**

Introduction to graphics communication. Dimensioning and tolerance practices. Geometrical construction. Orthographic projections. Machine drawing and introduction to computer aided design and Assemblies. (Total tuition time: not available)

**ENGINEERING MATHEMATICS I (EMA105B)****2 X 2-HOUR PAPERS****(Module custodian: Department of Mathematics and Statistics)**

Trigonometry, geometry, functions, complex numbers, vector algebra, matrices and transformations, single-variable differentiation and integration, partial differentiation, multiple-variable intervals, introduction to differential equations. (Total tuition time: not available)

**ENGINEERING MATHEMATICS II (EMA206B)****1 X 3-HOUR PAPER****(Module custodian: Department of Mathematics and Statistics)**

Mathematical modelling, first-order ordinary differential equations (ODEs), higher-order ODEs, Laplace transforms, systems of ODE's, numerical solutions of ODEs, Sturm-Liouville problems, partial differential equations. (Total tuition time: not available)

**ENGINEERING PRACTICE (EPR317B)****1 X 3-HOUR PAPER****(Module custodian: Department of Electrical Engineering)**

Engineering Communication; Project Management; Management and Ethics; Contracts and Intellectual Property; Entrepreneurship. (Total tuition time: ± 140 hours)

**ENGINEERING SOFTWARE DESIGN (ESG206B)****CONTINUOUS ASSESSMENT****(Module custodian: Department of Electrical Engineering)**

Variables and I/O, Loops (for/while). Program flow (if - else). Functions. Structures. Pointers. GUI's. Dynamic data types. Classes and Objects and Networking. (Total tuition time: ± 280 hours)

**G****GREEN ENERGY SYSTEMS (GES216B)****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 tuition time: ± 140 hours)

**I****INFORMATION LITERACY (INL125C)****CONTINUOUS ASSESSMENT****(Module custodian: Directorate of Library and Information Services)**

Introduction of information literacy. Development of a search strategy and application of a search string to search engines and academic databases. Evaluation of information sources. Ethical and legal use of information. (Total tuition time: ± 10 hours)



**L****LIFE SKILLS (LFS125X)****CONTINUOUS ASSESSMENT****(Module custodian: Directorate of Student Development and Support)**

Academic, personal and socio-emotional skills development for students in higher education. Personal and social dimensions address: Effective planning and self-management (goal setting and time management); Adjusting to university life (student life, diversity and change); Intra- and interpersonal skills development (conflict management, self-esteem, relationship management); Effective living (healthy living, HIV education, substance abuse). Academic dimension addresses: Academic skills for university (e.g. critical thinking, creativity, managing assignments and assessments). (Total tuition time:  $\pm 20$  hours)

**M****MECHANICS (1EM105B)****1 X 3-HOUR PAPER****(Module custodian: Department of Mechanical and Mechatronics Engineering)**

Introduction and SI units. Kinematics. Force's and Newton's laws of motion. Dynamics of uniform circular motion. Work and Energy. Impulse and momentum and rotational dynamics and torque. (Total tuition time:  $\pm 140$  hours)

**P****PHYSICS (SEP115B)****1 X 2-HOUR PAPER****(Module custodian: Department of Physics)**

Fluids, heat and thermodynamics, waves and sound, electric and magnetic fields and forces, electromagnetic waves and light. (Total tuition time:  $\pm 100$  hours)

**POWER SYSTEMS (PWS307B)****CONTINUOUS ASSESSMENT****(Module custodian: Department of Electrical Engineering)**

The basic operation and the requirements of the different types of power stations. Evaluate and comparison of the power stations in terms of their performance, cost-effectiveness and impact on the environment. Selection of the most economical supply system and conductor size for a new power line. Design of transmission lines. Sizing of cables for power distribution. Power flow analysis and stability analysis in planning and operation of power systems. Power system protection, the principle of operation of circuit breakers, fuses and relays. Analysis of fault levels in the power systems. Protective relaying in power systems. (Total tuition time:  $\pm 280$  hours)

**PROBABILITY AND STATISTICS (PAS206B)****1 X 3-HOUR PAPER****(Module custodian: Department of Mathematics and Statistics)**

Sampling techniques and descriptive statistics. Probability. Counting rules. Inferential statistics. Analysis of variance. Regression and correlation analysis. Non-parametric tests. (Total tuition time: not available)

**S****SIGNAL PROCESSING (SPR307B)****CONTINUOUS ASSESSMENT****(Module custodian: Department of Electrical Engineering)**

Introduction to signals and systems; Time-domain analysis of continuous-time systems; Signal representation by Fourier series; Continuous-time system analysis using Fourier transform; Continuous-time system analysis using Laplace transform; Frequency response and analogue filters; Discrete-time signals and systems; Time-domain analysis of discrete-time systems; Fourier analysis of discrete-time signals; Discrete-time systems analysis using the z-transform; Frequency response and digital filters. (Total tuition time:  $\pm 280$  hours)

