ELECTRICAL POWER ENGINEERING

2022
HANDBOOK

DUT
DURBAN UNIVERSITY OF TECHNOLOGY
INYUVESI YASETHEKWINI KUZOBUCHWEPHESHE

FACULTY OF ENGINEERING & THE BUILT ENVIRONMENT

HANDBOOK FOR 2022

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

DEPARTMENT OF ELECTRICAL POWER ENGINEERING

DEPARTMENTAL VISION

To provide professional leadership in generating, disseminating, and preserving knowledge in the Power Engineering discipline for productive citizenship.

DEPARTMENTAL MISSION

- Develop the social relevance of our programs and research to support our developing nation.
- Be informed by the university community and other stakeholders to facilitate professional career orientation.
- Develop teaching and infrastructure to inspire students to reach for the highest level of intellectual attainments and personal growth.
- Provide students with the necessary education to empower them to register as professionals in their careers.
- Provide research facilities and support for students and society.

DEPARTMENTAL AIMS AND OBJECTIVES

The general aims and objectives of the department are:

- to develop and enhance the critical, analytical and intellectual abilities of the student;
- to enable the student to conceptualize and deal with specific and complex issues and problems in the field of electrical engineering;
- to increase the student's ability to think independently and communicate clearly;
- to develop a rigorous critical approach to data collection and analysis to develop a strategic view of the complete electrical industry;
- to provide a basic practical familiarity with systems and components used in the electrical industry, and
- to prepare students to work both as a member of a team and independently on electrical projects.

WHAT IS A UNIVERSITY OF TECHNOLOGY?

A university of technology is characterized by being research informed rather than research driven where the focus is on strategic and applied research that can be translated into professional practice. Furthermore, research output is commercialized thus providing a source of income for the institution. Learning programs, in which the emphasis on technological capability is as important as cognitive skills, are developed around graduate profiles as defined by industry and the professions.

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IMPORTANT NOTICE

The departmental rules in this handbook must be read in conjunction with the Durban University of Technology's General Rules contained in the current General Handbook for Students

NOTE TO ALL REGISTERED STUDENTS

Your registration is in accordance with all current rules of the Institution. If, for whatever reason, you do not register consecutively for every year/semester of your programme, your existing registration contract with the Institution will cease. Your re-registration anytime thereafter will be at the discretion of the Institution and, if permitted, will be in accordance with the rules applicable at that time.

1. CONTACT DETAILS

All departmental queries to:

Secretary:	Mrs. R Naidoo
Tel No:	031 373 2062
Fax No:	031 373 2063
Location of Department:	Steve Biko Campus, S7 L300
Email Address	**reginan@dut.ac.za**

All Faculty queries to:

Faculty officer	Ms. N Singh
Tel No:	031 373 2718
Fax No:	031 373 2719
Location of Faculty office:	Steve Biko Campus, S4 L300
Email Address	**singhn@dut.ac.za**

Executive Dean:	Prof B Twala
Tel No:	031 373 2720
Fax No:	031 373 2724

Location of Executive Dean's office: Steve Biko Campus, S6 L5

2. STAFFING

	Name and Qualification
Head of Department:	**Prof I E Davidson**, Pr. Eng. (ECSA), C Eng. (UK), PhD (UCT), MEng, BEng (Hons) (Unilorin), PGDipBusMgt (UKZN), SEMAC (BCIT Canada), MCigre', MNSE, SMIEEE, FSAIEE, FIET.
Hon Professor:	**Prof J O Ojo**, PhD (Wisconsin), MEng, BEng (ABU), FNAE, FNAS, FIET, FIEEE.
Senior Lecturers:	**Dr E E Ojo**, PhD (UKZN), MSc (UKZN), BEng (Uniben), SAIMechE **Dr M Kabeya**, PhD (UP), MSc (ESIEE-Paris), M Tech (TUT), BSc (UNILU), MSAIEE, ECSA (Candidate Engineer). **Dr G Sharma**, PhD (MNIT, India), MTech (Hons.), (JMIU, India), BTech (PTU, India), ECSA (Candidate Engineer). **Mr E R Bussy**, MSc Eng. (UKZN); NDT (TN); Dip. Dat. (UNISA); GCC
Lecturers:	**Ms T F Mazibuko**, MTech (TUT), BTech Eng. (TUT) **Mr K T Akindeji**, MSc, BScEng, (OAU), MSAIEE, Pr. Tech (ECSA) **Mr C Leoaneka**, MSc (UKZN) **Mr K Loji**, BTech. Eng. (VUT); MSc (UCT), MSAIEE **Mr R A Stops**, BTech Eng. (TN); BMDP; MSAIEE **Mr D Reddy**, MEng., BTech Eng. (DUT) **Mr AA Adebiyi**, MEng (DUT), HND, Cand. Eng. Tech (ECSA) **Ms N Mtukushe**, BTech Eng., MEng (DUT) **Ms. S C Malanda**, BTech Eng., MEng (DUT); Cand. Tech (ECSA)
Specialist Instructors:	**Mr D Chetty**, BTech Eng., MEng (DUT) **Mr M Estrice**, BTech, MEng (DUT); NTD; HDE; Pr. Tech (ECSA)
PD Research Fellows:	**Dr E Buraimoh**, DEng (DUT), MSc, BTech Eng. (ABUD) Cand. Eng. Technologist (ECSA)
Secretary:	**Mrs. R V Naidoo**; BTech: Commercial Administration (MLST)
Technicians:	**Mr S Moodlier**, BTech, Management (DUT) **Mr S Lafleni**, BTech (DUT) **Ms N Mazibuko**, BTech (DUT) **Mr D L Ramouthar** **Mr V V Nemudzivhadi**, BTech (VUT)

3. PROGRAMMES OFFERED BY THE DEPARTMENT

The engineering profession contributes to the technical, social, economic and environmental infrastructure of the country, leading to socio-economic growth. A framework of engineering qualifications develops the human resources essential for sustaining the profession. The qualifications offered in this Department are as follows:

Qualification	SAQA NLRD Number
B Eng. Tech (Power Engineering)	99611
M Eng.: Engineering	96827
D Eng.: Engineering	96812

4. PROGRAMME INFORMATION AND RULES: BACHELOR OF ENGINEERING TECHNOLOGY IN POWER ENGINEERING

This three-year qualification is primarily industry oriented. The knowledge emphasizes general principles and application or technology transfer. The qualification provides students with a sound knowledge base in Electrical Power Engineering. They will develop the ability to apply knowledge and skills in this field, and they will be equipped to undertake more specialized and intensive learning. The programs leading to this qualification will have a strong professional and career focus.

Specifically, the purpose of the educational programme to meet this qualification is to build the necessary knowledge, understanding, abilities and skills required for further learning towards becoming a competent practicing engineering technologist in Electrical Power Engineering. This qualification provides:

i) Preparation for careers in Electrical Power Engineering itself and areas that potentially benefit from these skills, for achieving technological proficiency and to make a contribution to the economy and national development.

ii) The educational base required to apply for registration as a Professional Engineering Technologist with ECSA. (Refer to qualification rules)

iii) Entry to NQF level 8 programs e.g. Honours, and Post Graduate Diploma Programs, and then to proceed to Masters Programs.

iv) For professional engineering technologists, this degree provides the education base for achieving proficiency in mining/ factory plant and marine operations and occupational health and safety.
Engineering students completing this qualification will demonstrate competence in all the Graduate Attributes indicated below.

This Degree is abbreviated as **BEngTech (Power Engineering)**

a) Suitable Candidate Selection

In addition to the general admission requirements as stated in the General Rules, the following minimum results are required for admission:

Compulsory Subjects	**National Senior Certificate**	**National Certificate, (Vocational)**	**Senior Certificate**	
	Rating	**Mark**	**HG**	**SG**
Mathematics (Not Mathematics Literacy)	4			
Physical Science	4			
English (Primary), or	4			
English (First additional)	4			
Three more 20 credit NSC subjects	4			
English		60 %		
Mathematics		70 %		
Life Orientation		60 %		
Physical Science		70 %		
Three other relevant NCV vocational subjects		70 %		
English			E	C
Mathematics			E	C
Science			E	C
Two more vocational subjects			E	C

- Selection of students is strictly on merit. Where there are more students than places available, selection will be based on academic performance in English, Mathematics, and Physical Science.

- In addition, applicants with a National Senior Certificate will be ranked according to the sum of their percentage results for Mathematics and Physical Science.

- Final selection is made at the full discretion of the Head of Department based on a number of factors including class size, and equity.

b) Programme Structure: BEngTech

Modules in the BEngTech are listed in the table below and all are compulsory.

The method by which they will be examined is indicated in each module study guide. In modules where Graduate Attributes (GA) are assessed, the student must meet both the academic and the GA requirements, as specified in the relevant study guide, in order to pass the subject.

The three-year degree is divided into Study Levels 1 to 3, where each Study Level is equivalent to one year.

Subject	Subject Code	Year/ Sem	NQF Level	Module Credit	Pre-Req.	Co-Req
Engineering Mathematics 1A	EMTA101	1A	5	12		
Projects 1	PRJS101	1A	5	12		
Engineering Physics 1A	EPHA101	1A	5	12		
Cornerstone Module 101	CSTN101	1A	5	12		
Technical Literacy	TLPE101	1A	5	8		
Computing & IT	CPIT101	1A	6	12		
Mechanics of Machines 1	MCHM101	1B	5	12		
Engineering Mathematics 1B	EMTB102	1B	6	12		
Engineering Physics 1B	EPHB101	1B	6	12		
Electrical Principles 1	ELEP101	1B	5	12		Physics 1B
Analogue Electronics1A	ANLE101	1B	5	12		
Digital Electronics 1A	DGTE101	1B	6	12		
Mechanical Technology 1	MTCH102	2A	6	12	Mech of Mach 1	
Engineering Mathematics 2A	EMTA202	2A	7	12	Maths 1A; Maths 1B	
Electrical Applications	EAPP101	2A	6	8	Electr Principles 1	
Electrical Principles 2	ELEP201	2A	6	12		
Instrumentation and Control	INCT101	2A	6	12		
Project Management	PMAN101	2A	6	8		
Computer Programming 2	COMP201	2A	6	12	Computing & IT	
Mechanical Technology 2	MTCH202	2B	6	12	Mechanical Technology 1	
Engineering Mathematics 2B	EMTB202	2B	7	12		
Engineering Drawing and Design	EDRD101	2B	6	12	Projects 1	

Subject	Subject Code	Year/ Sem	NQF Level	Module Credit	Pre-Req.	Co-Req
Electrical Machines 1	EMCH101	2B	6	12	Elect Applications Electr Principles 2	
Power Systems 1	PWRS101	2B	6	12	Electr Principles 1 Electr Principles 2	
Illumination	ILLM101	2B	7	8		
Mechanical Technology 3	MTCH302	3A	7	12	Mech Tech 2	
Strengths of Materials 1	STMT101	3A	7	12		
Design Project 1	DSPJ101	3A	7	12	Eng Draw & Design	
Electrical Machines 2	EMCH201	3A	7	12	Elect Mach 1	
Power Systems 2	PWRS201	3A	7	12	Power Sys 1	
Power Electronics	PWEL101	3A	7	12		
Environmental Engineering	EVEN101	3B	7	8		
Strengths of Materials 2	STMT101	3B	7	12	Str of Mat 1	
Design Project 2	DSPJ101	3B	7	12		Design Proj 1
Utilization of Electrical Plant	UTEP101	3B	7	8		
Electrical Protection	EPRT101	3B	7	12	Power Sys 2	
Renewable Energy Systems	EPRT101	3B	7	8		
Principles of Management	PMGM101	3B	7	8		

c) Graduate Attributes

Engineering students completing this qualification shall demonstrate competence in all the following Graduate Attributes (GA) indicated below, as required by the Accrediting body – the Engineering Council of South Africa (ECSA). Assessment of these GA's are embedded in the modules of the degree. In modules where Graduate Attributes (GA) are assessed, the student must meet both the academic and the GA requirements, as specified in the relevant study guide, to pass the subject.

i) Graduate Attribute 1: Problem Solving:
Students will be required to apply engineering principles to systematically diagnose and solve broadly-defined engineering problems in modules at all levels.

ii) Graduate Attribute 2: Application of scientific and engineering knowledge:
Students will be required to apply knowledge of mathematics, natural science, and engineering sciences to defined and applied engineering procedures, processes, systems and methodologies to solvebroadly-defined engineering problems.

iii) Graduate Attribute 3: Engineering Design
Students will be required to perform design tasks in Projects at all levels. Work will be more of a procedural nature at the first level and will increased in complexity through the levels.
In Design Projects A & B, the preliminary part of the design will be carried out in part A, while part B will see to the project completion. The project will include one or more of the following impacts: social, economic, legal, health, safety, and environmental. Design Projects A & B are to be seen collectively as one large project.

iv) Graduate Attribute 4: Investigation
Students will conduct investigations of broadly-defined problems through locating, searching, and selecting relevant data from codes, data bases, and literature, designing and conducting experiments, analyzing and interpreting results to provide valid conclusions.

v) Graduate Attribute 5: Engineering methods, skills, tools, including Information technology
Use of appropriate techniques, resources, and modern engineering tools, including information technology, prediction and modelling, for the solution of broadly-defined engineering problems, with an understanding of the limitations, restrictions, premises, assumptions and constraints will be embedded in all modules.

vi) Graduate Attribute 6: Professional and Technical Communication
Students will be required to demonstrate the ability to communicate effectively, by submitting research assignments and deliver oral presentations, with engineering audiences and the affected parties.

vii) Graduate Attribute 7: Impact of Engineering Activity
Demonstrate knowledge and understanding of the impact of engineering activity will be embedded in many courses as well as specifically in the module of Environmental Engineering.

viii) Graduate Attribute 8: Individual and Teamwork
Knowledge and understanding of engineering management principles will be specifically covered in the Module of Entrepreneurship Skills. Individual and teamwork competency will be addressed in other modules as well.
The ability to manage a project will be demonstrated in the module Design Projects A & B.

ix) Graduate Attribute 9: Independent Learning
Engage in independent and life-long learning through well-developed learning skills.

x) Graduate Attribute 10: Engineering Professionalism
Students will be assessed on their comprehension and application of ethical principles and commitment to professional ethics, responsibilities, and norms of engineering technology practice.

xi) Graduate Attribute 11: Engineering Management Demonstrate knowledge and understanding of engineering management principles and economic decision-making

d) Progression Rules

Students registered for this degree shall meet the following progression rules:

i) The student shall obtain at least 80 credits in Study Level One to progress to Study Level Two.
ii) The student shall obtain at least 80 credits in Study Level Two to progress to Study Level Three.
iii) The student shall pass ALL the modules in study level one BEFORE he/ she is permitted to register for ANY subjects in study level three.

e) Unsatisfactory Academic Progress

Students who do not achieve the minimum number of accumulated credits in each year of registration as specified in the table below, will be regarded as having Unsatisfactory Academic Progress, and will not be permitted to continue with the degree unless an appeal to continue is upheld, (refer to G 1 (8) for appeals).

END OF YEAR	MINIMUM ACCUMULATED CREDITS
1	80
2	160
3	240
4	320
5	420

f) Eligibility for Exams

In addition to G12, the method if assessment of each module is published in that module's particular Study Guide.

g) ABSENCE FROM CLASS TESTS AND PRACTICAL SESSIONS

A special test may be granted by the Head of Department to a student who has been prevented from taking a test:
(Where the student is unable to return to class within two days of missing the event, it is the student's responsibility to contact the department to inform them of the late return. Documented proof of the reasons for absence must then be submitted within two (2) working days of returning.)

i. By illness on the day of the test or immediately before it, provided that he/she submits a medical certificate on the prescribed form G194 on which a medical practitioner, registered by the Health Professions Council of SA, homoeopath or chiropractor, registered with the South African Associated Health Board, specifies the nature and duration of the illness and that for health reasons it was impossible or undesirable for the student to sit for the test, and that he/she submits such certificate to the Head of Department on the day as determined by the practitioner that the student should return to lectures immediately following such illness, or on one of the two following working days;

Note: Medical certificates issued after the student's recovery will not be accepted under any circumstances.

OR

ii. By circumstances which in the opinion of the Head of Department were beyond his/her control at the time of the test provided that satisfactory evidence of such circumstances is provided. Such circumstances shall not include:
   (1) any misinterpretation by him/her of the date, time or venue of the test;
   (2) transportation difficulties, where his/her residential term time address is within the area serviced by a scheduled bus or commuter train service to central Durban area, and provided otherwise that he/she informs the Head of Department of such difficulty prior to the time of commencement of the test;
   (3) failure by him/ her to bring to the test venue any equipment normally required for that subject as specified in the study guide for the particular subject;
   (4) participation in events, unless the student is granted permission to be absent BEFORE the evaluation takes place.

   For the purpose of this rule, "test" shall mean any written, oral or practical test, set for the purpose of determining or contributing towards a semester mark for a subject, and shall include tests set for subjects which are evaluated by continuous evaluation.

   Any student who misses a test and who does not qualify for a special test, and any student who qualifies for a special test and fails to write it, shall be awarded a zero mark for the missed test.

h) CONDUCT

This is to be read in conjunction with the STUDENT CODE OF CONDUCT in the General Handbook:

(1) Class Rooms and Laboratories
(2) Disruptive behavior and vandalism will be dealt with in terms of the student disciplinary code.
(3) Eating, smoking or drinking in the classrooms is strictly forbidden.
(4) Safety rules must be strictly observed at all times.
(5) Attendance and punctuality are essential.

i) TOOLS

Students are expected to supply their own basic tools as required in certain subjects as specified in the relevant study guide. All student's registering for this programme for the first time will be required to pay a toolkit levy in addition to the standard course fee.

j) PROJECT FEE

Students registering for project-based subjects may be required to pay a project fee in addition to the standard tuition fee.

RULES FOR POST GRADUATE DEGREES

a) NAME OF DEGREE: MASTER OF ENGINEERING :

This is abbreviated as **M Eng.**

i. PURPOSE STATEMENT

This qualification is intended for persons who will make a contribution, through research, to understanding the application and evaluation of existing knowledge in a specialized area of technology. They will also demonstrate a high level of overall knowledge in that area, ranging from fundamental concepts to advanced theoretical or applied knowledge.

ii. Rules

See Rules G24 and G26 in the Rule Book for Students, and the Postgraduate Handbook.

Students interested in a suitable research programme should contact the Head of Department.

b) NAME OF DEGREE: DOCTOR OF ENGINEERING :

This is abbreviated as **DEng.**

i. PURPOSE STATEMENT

This qualification is intended for persons who will make a significant and original contribution to knowledge in a specialized area of technology. They will have a high level of overall knowledge in that specialized area ranging from fundamental concepts to advanced theoretical or applied knowledge.

ii. RULES

See Rules G25 and G26 in the Rule Book for Students, and the Postgraduate Handbook.

Students interested in a suitable research programme should contact the Head of Department.

6) SUBJECT CONTENT
BACHELOR OF ENGINEERING TECHNOLOGY

ENGINEERING PHYSICS 1A
Units, Physical Quantities, Vectors; Standards and Units; Unit Consistency and Conversions; Precision and Significant Figures; Vectors and Vector Addition; Components of vectors

ENGINEERING MATHEMATICS 1A
Numbers and Algebra; Areas and Volumes; Trigonometry; Graphs; Complex Numbers; Calculus - Differentiation & Integration

PROJECTS 1
Introduction to project work; Basic hand skills; Select and utilize engineering equipment correctly and safely; Use engineering tools to work accurately to the require specifications; Design and manufacture of a small project; report writing; Produce a safe, working and acceptable artefact

CORNERSTONE MODULE (DUT101)
Proficiency and Competencies, including; Information literacy; Communication (oral and written); Technology applications; Quantitative Reasoning; Innovation; Leadership; Social Responsibility; Critical and engaged citizenry embedded in a local and global context; Personal Development; Self-awareness; Self-directed and life-long learning

TECHNICAL LITERACY
The differences between language usage in academic, technical and common environments; Experimental methods and the scientific method; Planning and documenting experiments; Technical Report writing; Referencing practice; Utilising spreadsheets for graphical presentation of information; Standards (ISO, SABS, etc)

COMPUTING & IT
The hardware structure of a digital computer; Computer Networks; Operating Systems; Software Applications; Data Protection and Security;

MECHANICS OF MACHINES 1
Forces on bodies; Identify and analyse concurrent, coplanar forces on bodies; Interaction between forces and structures; Moments caused by forces; Determination of centres of gravity Friction; Work done by forces on bodies in motion; Derive the equations of motion; Newton's Laws Second Law; Apply equations of uniform accelerated motion; Energy; Apply principle of conservation of energy; Momentum and Impulse; Analyse engineering problem in terms of force and apply principle of conservation of energy

ENGINEERING MATHEMATICS 1B
Linear Algebra; Trigonometry; Maclaurin Series; Advanced Calculus – Differentiation; Advanced Calculus – Integration; Differential Equations; Statistics and Probability

ENGINEERING PHYSICS 1B
Atomic and Molecular Theory and Structure; Coulomb's Law and Electric Charges; Current, Resistance, and Capacitance; Energy storage and dissipation; The Magnetic Field, flux and motion of charges; Mutual and self-inductance; Combining R, L, and C in circuits; Maxwell's Equations; Electromagnetic Waves; Nature and Propagation of Light; Thermodynamics

ELECTRICAL PRINCIPLES 1
Established electrical principles and laws; Network theorems, conversions and applications; Passive components in DC circuits

ANALOGUE ELECTRONICS
Semiconductor Theory; Diode Applications; Special Purpose Diodes; Bipolar Junction Transistors; BJT Amplifiers; Electronic test and measurement equipment; Computer electronic circuit simulation

DIGITAL ELECTRONICS 1A
Introduction to digital electronics; Number systems and codes;
Basic logic functions; Logic tools and techniques; Combinational logic circuits; Introduction to sequential logic; Simulation of logic circuits; Introduction to programmable logic devices (PLDs)

MECHANICAL TECHNOLOGY 1
Friction; Screw jack; Lubrication and bearing; Friction Clutches; Belt, Rope and Chain Drives; Gears; Gear Trains; Brakes and Dynamometers; Mechanical Governors

COMPUTER PROGRAMMING & IT
Using a high-level computer programming language to solve an engineering problem; Top Down Design; Programming concepts; Use of IDE to create and debug a working application; Program structure; Control structures; Loop structures; Timing; File access

ENGINEERING MATHEMATICS 2A
Introduction to Partial Differential Equations; Statistics and Probability; Statistical distributions; Linear regression; Second Order Differential Equations; Laplace Transforms for solution of Single and Simultaneous Differential Equations; Fourier Series for Periodic Functions and Non- Periodic Functions

ELECTRICAL APPLICATIONS
Magnetic fields, systems; and circuits; Causes of and protection against corrosion in conductive materials; Electrical heating and cooling of spaces and materials; Vibrations in air and machinery

ELECTRICAL PRINCIPLES 2
Introduction to Alternating Current (AC); Resistors, Capacitors, and Inductors, in AC circuits; Resonance; Analysis of AC circuits; Network theorems and conversions; Introduction to Three-Phase Systems

INSTRUMENTATION AND CONTROL
Modern industrial instrumentation; Process control and control methods; Measurement of physical variables; Signal processing and data presentation; Principles of operation of various transducers and their application to typical instrumentation systems; Programmable logic controllers (PLC)

PROJECT MANAGEMENT
Project Management within Context; Modern Project planning methods, tool, analysis and computer applications; Oral and written communication of project planning; Project Implementation Support of the operational systems

MECHANICAL TECHNOLOGY 2
Understand the fundamentals of friction analysis of machine components; Understand the various independent technical approaches that exist in the field of mechanisms, kinematics, and dynamics; Demonstrate enhance problem-solving skills that involves frictional effect through creative design of mechanism such as screw jack and clutches; Ability to perform quasi-static and dynamic force analyses of planar machine such as belts, rope and gears in power transmission; Identify the ordinary and planetary gear trains and to determine the speed ratios between the input and output shafts; Understand the principle and design brakes and clutches; To perform complete kinematic analyses of planar mechanisms such as governors

ENGINEERING MATHEMATICS 2B
Analysis and Calculus; Linear Algebra; Systems of Ordinary Differential Equations; Complex Analysis; Properties and derivatives of Complex Numbers and Complex analysis; Partial Differential Equations; Poisson's and Laplace's Equations; Potential, Heat, and Wave Equations; z -Transforms

ENGINEERING DRAWING AND DESIGN
Relay/ Electromagnetic switch; Basic Principles of operation; Contact arrangement; Electromagnetic circuit; Types of relays; Ratings of relays; Contactors; Contactor ratings, design and operation; Schematic symbols and Circuit design; Computer aided drawing and design; Technical Report Writing

ELECTRICAL MACHINES 1
DC Machines, motors and generators; Single Phase Transformers; 3 Phase Induction Motors; 3-Phase Synchronous Machines

POWER SYSTEMS 1
Three phase circuit theory; Connection of loads in 3-phase systems (Y/Delta, Balanced or Unbalanced); Power in Three phase; Symmetrical components; Interconnected systems and transmission –line parameters; Power systems representation (per-unit systems); Two port networks; AC and DC distribution

ILLUMINATION
Lighting concepts and fundamentals of Illumination Science and Technology; Light Sources and Luminaires; Lighting Codes and Energy Efficient Lighting Systems; Renewable Energy based Lighting Systems; Photometry, Photometry Measurement and Colorimetry; Lighting and Illuminance Calculations

MECHANICAL TECHNOLOGY 3
Hydrostatics and applications of hydrostatics; Hydrodynamics, Bernoulli's equations and its applications; Water wheels, Impulse and reactions Turbines; Centrifugal pumps; Reciprocating pumps; Hydraulic systems

STRENGTHS OF MATERIALS 1
Introduction to Strength of Materials; Equilibrium of deformable body; Stress; Axially loaded members; Average shear stress; Allowable stress; Thin-walled pressure vessels (cylindrical and spherical); Design of simple connections; Deformation (strain); The tension and compression test; The stress-strain diagram; Stress-strain behavior of ductile and brittle materials; Hooke's law; Poisson's ratio; The shear stress-strain diagram; Principle of superposition; Torsional deformation of a circular shaft

DESIGN PROJECT 1
Research methods; Literature Review; Plagiarism; Referencing; Design Concepts; Formulation of a proposal

ELECTRICAL MACHINES 2
Construction and principle of operation of: Three Phase Induction Motors, Three Phase Transformers, Three Phase Synchronous Machines, and Control of Machines

POWER SYSTEMS 2
Overview of Power Generation Technologies;
General Concepts of Distribution Systems; Introduction, Load modelling and characteristics; Classification and characteristics of loads;
Distribution Feeders and Design Considerations of various types of primary feeders and their voltage levels; Feeder loading; Substations: Location, Rating, service area within primary feeders; System Analysis; Voltage drop and power-loss calculations; Distribution Protection System; Practical means of Compensating for Power Factor Correction; Voltage Control

POWER ELECTRONICS
The importance of Power Electronics in the world of Engineering; Controlling power using switching devices; Controlling power using rectifiers; The application of controlled rectifiers

STRENGTHS OF MATERIALS 2
Shear force and bending moment diagrams; Graphical method for constructing shear and moment diagrams; Properties of an area: first and second moment of the area; Stresses in bending; Composite beams; Reinforced composite beams; Deflection of beams: the elastic curve; Moment-curvature relationship; Slope and displacement by integration; Deformation (strain); Discontinuity functions; Plane-stress transformation; General equations of stress transformation; Principal stresses ; Maximum in-plane shear stress; Mohr's Circle for plane stresses

DESIGN PROJECT 2
Using research sources for practical applications; Engineering design associated with the selected research activity; Production of a report on the research and design activities selected; Production of a presentation covering the activities selected

RENEWABLE ENERGY SYSTEMS
Energy resources and technologies; Energy transfer; Sustainable design; Power conversion and integration technologies; Wind turbines; Solar power; Marine energy; Energy generation from biomass; Geothermal energy; Waste and energy; System integration and automation; Exploitation of renewable energy resources; Socio-economics of renewable energy

ELECTRICAL PROTECTION
Electrical Fault Analysis; Over current protection; Over voltages; Neutral Earthing Systems; Instrument Transformers; Fuses and Circuit Breakers

UTILIZATION OF ELECTRICAL PLANT
Electric Traction; Industrial Application of Electric Motors; Rating and Service Capacity of Electric Motors; Electronic Control of Electrical Motors; Electric Heating; Electric Welding

ENVIRONMENTAL ENGINEERING
Electric Traction; Industrial Application of Electric Motors; Rating and Service Capacity of Electric Motors; Electronic Control of Electrical Motors; Electric Heating; Electric Welding

PRINCIPLES OF MANAGEMENT
The Environment in which People Work; Key concepts of Management; Human Resource Management; The Labour Relations Act; Managing People and Teams

7) GENERAL INFORMATION

(a) Central Applications Office (CAO) Private Bag X06, Dalbridge, 4014

(b) Contact (Office No.) 031-2684444**, Website:** **www.cao.ac.za**

(c) Engineering Council of South Africa (ECSA) Private Bag X691, Bruma, 2026

Contact (Office No: 011-6079500
Faxline(Office) : 011-6229295

(d) South African Institute of Electrical Engineers (SAIEE)
SECRETARY: Ms Gill Nortier, P O Box 22222, Glenashley, 4022
Contact Details: 031-5725838
Email : saiee@africa.com **Website: www.saiee.org.za**

(e) South African Qualifications Authority (SAQA) Postnet Suite 248, Private Bag X06, Waterkloof, 0145

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E&OE