2023
HANDBOOK

DUT
DURBAN UNIVERSITY OF TECHNOLOGY
INYUVESI YASETHEKWINI YEZOBUCHWEPHESHE

FACULTY OF ENGINEERING & THE BUILT ENVIRONMENT

ELECTRICAL POWER ENGINEERING

HANDBOOK FOR 2023

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

The Departmental mission is to:

- 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.

CONTENTS

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 F J Nemavhola

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**, PhD (UCT), MEng, BEng (Hons) (Unilorin), PGDipBusMgt (UKZN), SEMAC (BCIT Canada), MCigre', MNSE, SMIEEE, FSAIEE, FIET, Pr. Eng. (ECSA), C Eng. (UK)
Secretary:	**Mrs R V Naidoo**; BTech: Commercial Administration (MLST)
Hon Professor:	**Prof J O Ojo**, PhD (Wisconsin), MEng, BEng (ABU), FNAE, FNAS, FIET, FIEEE
Senior Lecturers:	**Dr K T Akindeji**, PhD (UKZN), MSc, BScEng, (OAU), MSAIEE, Pr. Tech (ECSA)
	Mr E R Bussy, MSc Eng. (UKZN), NDT (TN); Dip. Dat. (UNISA); GCC
	Dr M Kabeya, PhD (UP), MSc (ESIEE-Paris), M Tech (TUT), BSc (UNILU), MSAIEE, Cand. Eng. (ECSA)
	Dr K Moloi, DEng (TUT), MEng (TUT), MSAIEE, MIET (UK), PrTech Eng (ECSA)
	Dr E E Ojo, PhD, MSc (UKZN), BEng (UNIBEN), SAIMechE
Lecturers:	**Dr A A Adebiyi**, DEng (DUT), MEng (DUT), HND, Cand. Eng. Tech (ECSA)
	Mr D Chetty, MEng (DUT), BTech Eng (DUT), NDP (TN)
	Mr M C Leoaneka, MSc Eng. (UKZN), BSc Eng. (UKZN), Cand. Eng. (ECSA)
	Mr K Loji, MSc (UKZN), BTech Elec (VUT), MSAIEE, AMEI (UK)
	Ms S C Malanda, MEng (DUT), BTech Eng, Cand. Tech (ECSA)
	Ms T F Mazibuko, MTech (TUT), BTech Eng (TUT)
	Ms N Mtukushe, MEng (DUT), BTech Eng,
	Dr O E Oni, PhD, MSc (UKZN), BEng(Hons) (EKSU)
	Mr D Reddy, MEng, BTech Eng. (DUT)
	Mr R A Stops, MEng (DUT), BTech Eng (TN); BMDP, MSAIEE
Senior Technician:	**Mr V V Nemudzivhadi**, BTech (VUT)

Technician:	**N Bukhosini,** Adv. Dip, Dip Info. Comm. Tech (DUT)
	S P Lafleni, B Tech (DUT)
	N Mazibuko, MEng (DUT), B Tech (DUT)
	S E Ngonyama, NDIP (DUT)
Technical Assistant:	**N W Ndlela,** MEng (DUT), BTech Eng,
Space Research Administrator:	**Ms S Sithole**, BTech Public Management (DUT), NDip

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
BEngTech Hons (Power Engineering)	TBA
M Eng.: Engineering	96827
D Eng.: Engineering	96812

4. PROGRAMME INFORMATION AND RULES FOR:

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, 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

i) 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.

ii) In addition, applicants with a National Senior Certificate will be ranked according to the sum of their percentage results for Mathematics and Physical Science subject to a minimum combined score of 100.

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	
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 solve broadly-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 1 & 2, the preliminary part of the design will be carried out in part 1, while part 2 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 1 & 2 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 1 & 2.

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.

5. PROGRAMME INFORMATION AND RULES:

BACHELOR OF ENGINEERING TECHNOLOGY WITH HONOURS IN POWER ENGINEERING

The Bachelor of Engineering Technology Honours Degree is considered to be a postgraduate specialization qualification designed to prepare students for careers in engineering and related areas as well as higher level postgraduate studies. This program is designed specifically to follow the Bachelor of Engineering Technology in Power Engineering (BEngTech (Power Engineering)), as offered at the Durban University of Technology (DUT).

The qualification consolidates and deepens the graduate's expertise in Power Engineering and develops research capacity in the methodology and techniques of those disciplines, while equipping them to undertake more specialised and intensive learning. Programmes leading to this qualification allow students to work independently and responsibly, applying original thought and judgment to technical and risk-based decisions in complex situations and holders of this qualification are normally prepared to enter a specific niche in the labour market, or to further their studies through Masters and Doctoral programmes.

Specifically, the purpose this programme is to further the necessary knowledge, understanding, abilities and skills required for towards becoming a competent practicing engineer. This qualification provides:

i) Preparation for careers in engineering and related areas, for achieving technological proficiency and leadership and to contribute to the economy and national development;

ii) Together with the BEngTech (Power Engineering), as offered at DUT, a thorough grounding in mathematics, natural sciences, engineering sciences, engineering modelling, engineering design and the abilities to enable applications in fields of emerging knowledge together with an appreciation for the world and society in which engineering is practiced;

iii) Entry to NQF level 9 Masters Programmes and the ability to then proceed to Doctoral Programmes.

The BEng Tech Hons (Power Engineering), to be offered at DUT, has been structured such that the requirements, allocated to the six specified knowledge areas and the eleven graduate attributes[1] (GAs), meet or exceed those specified in the ECSA E-09-PT standard.

It is envisaged that graduates with the BEngTech (Power Engineering) degree, this Honours degree and the future professional coursework Master's degree will meet the academic requirements for registration as Professional Engineers with the

[1] See B Eng Tech degree rules for the list of Graduate Attributes.

Engineering Council of South Africa, (ECSA). This can only be finalised when the Master's degree is offered.

a) Minimum Admission Requirements

In addition to the general admission requirements as stated in the General Rules, G23C (1) the applicant shall have graduated with an appropriate bachelor's degree OR have been granted Conferment of Status OR Advanced Standing via Recognition of Prior Learning.

b) Suitable Candidate Selection

Where the number of applications received is more than the number of places available, suitable candidates will be selected as follows:

i. Selection will be based on academic performance in the final year of the appropriate bachelor's degree.

ii. Preference will be given to graduates from Durban University of Technology.

iii. Where an applicant does not have an appropriate Bachelor's Degree from this University, he/ she may be required to apply for Conferment of Status.

iv. All applicants must apply using the FEBE 24 Post Graduate Application form, available from the Departmental Secretary.

c) Programme Structure

The qualification code for this Honours degree is **BHTPWE**. For the structure, please refer to the table and notes below:

Sem	Module title	Module Code	HESQF Level	SAQA Credit	Exam or Continuous Assessment Mode (CA)	Pre- Co-Requisite	Compulsory or Elective
SEMESTER ONE MODULES							
1	Statistics and Probability	STAP801	7	8	Exams		C
1	Power System Engineering 1	PSEN801	8	12	Exams		C
1	Electromagnetic Field Theory	ELFT801	8	8	Exams		C
1	Engineering Design Project	ENDP801	8	32	CA		C
In Semester One, choose at least 2 electives from the list below							
1	Electrical Protection Engineering	EPRE801	8	8	Exams		E
1	Electrical Machines and Drives	ELMD801	8	8	Exams		E
1	Renewable Energy Technology	RNET801	8	8	Exams		E
1	Automation	AUTP801	8	8	Exams		E
SEMESTER TWO MODULES							
2	Engineering Research Project	ENRP801	8	36	CA		C
2	Power System Engineering 2	PWSE802	8	12	Exams		C
2	Innovation Management and Entrepreneurship	IMEP802	8	8	Exams		C
In Semester 2, choose at least 2 eight credit electives OR 1 sixteen credit elective from the list below							
2	PV and Energy Storage Systems	PVES802	8	8	Exams		E
2	DC Distribution Systems	DCDS802	8	8	Exams		E
2	High Voltage Engineering	HVSS802	8	8	Exams	Electromagnetic Field Theory (Pre-req)	E
2	Control Systems	CNRS802	8	16	Exams	Automation (Pre-Req)	E

i) Modules in the degree are listed in the table. Compulsory modules are indicated with a **C**. 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, to pass the subject.

ii) A minimum of 140 credits is required for the student to graduate.

d) Duration of Programme

One-year full time study

e) Promotion to a Higher Level/ Progression rules

There are no rules for progression as the qualification is a one-year offering. In the case of pre-requisite, the student must pass the pre-requisite subject prior to continuing.

f) Unsatisfactory Academic Progress

i) Rules G23C (3) Rule G17 applies

ii) Students can appeal G17 through the G17 appeal process

g) Exclusion Rules

A student who fails to complete all the requirements of this Honours degree within the maximum duration specified by Rule G23C (3) shall be excluded from further registration.

h) Assessment rules

As per General Rule G 13 and details as per module Study Guides

6. RULES THAT APPLY TO ALL PROGRAMMES OFFERED BY THE DEPARTMENT:

a. 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.

b. Conduct

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

(1) Classrooms 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.

c. 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.

d. 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

7. NAME OF DEGREE: MASTER OF ENGINEERING:

This is abbreviated as **M Eng.**

a. 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.

b. Rules

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

c. Application

All applicants must apply using the FEBE 24 Post Graduate Application form, available from the Departmental Secretary.

8. NAME OF DEGREE: DOCTOR OF ENGINEERING :

This is abbreviated as **DEng.**

a. 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.

b. Rules

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

c. Application

All applicants must apply using the FEBE 24 Post Graduate Application form, available from the Departmental Secretary.

9. 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 analyze 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; Analyze 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

10. SUBJECT CONTENT: BACHELOR OF ENGINEERING TECHNOLOGY (HONOURS)

AUTOMATION
Energy; Plat automation process/ platform; Automation and control; Static and dynamic properties of sensors and actuators; Unconstrained single-input-single-output model predictive control; PLC ladder programming and economic evaluation of automation system

CONTROL SYSTEMS
Introduction: Identify the difference between modern control and classical control; Define open- and closed-loop control systems; Modelling of Physical Systems; Develop time-domain mathematical models of real world control systems; Develop Laplace Transform of Modelled System; Classical Control: Apply transformations to determine canonical form of closed loop systems; Analyze closed-loop response to step, ramp and impulse inputs; Measure the performance of system response to a given input; Sketch and analyze Bode, Root Locus, and Polar plots for system frequency response; State Space Analysis: Develop State Space Models; Determine System Controllability and System Observability; Microcontrollers: operation and Applications of microcontrollers

DC DISTRIBUTION SYSTEMS
Microgrid technology; Photovoltaic (PV) in microgrids; Wind farms in microgrids; Battery energy storage systems in microgrids; Coordinated control of renewable energy sources in microgrids; Energy management in microgrids

ELECTRICAL MACHINES AND DRIVES
Overview of different types of electrical motor drives; Types of loads; Impact of using mechanical gears/ transmission; Simplified models of commonly used power electronic converters; Modulation methods; Measurement techniques used in motor drives; Controller and tuning of controller parameters; Mathematical modelling of DC drives; Analysis of steady state characteristics; Selection and dimensioning of current and speed controllers; Permanent Magnet Synchronous Motor Drives; Induction Motor Drives; Synchronous Motor Drives

ELECTRICAL PROTECTION ENGINEERING
Philosophy of Power System Protection; Review of Per-unit System; Symmetrical Fault Analysis using Z-bus; Symmetrical Components and Sequence Networks; Unsymmetrical Fault Analysis using Z-bus; Protection of Distribution Network; Differential Protection; Transmission Line Protection; Digital Relaying Principles

ELECTROMAGNETIC FIELD THEORY
Principles of electro-magnetism; Electric charges; charge density; Charge Distribution; Coulomb's Law; Electric Fields; Gauss's Law; Electrostatic Potential; Magnetic field of steady

state currents; Electromagnetic induction; Electro-mechanics; Industrial Applications

ENGINEERING DESIGN PROJECT
Work to develop, design, prototype and test an electronic and/or computer engineering-based project as well as communicate both verbally and in writing the project deliverables at a professional level

ENGINEERING RESEARCH PROJECT
What is Research; An introduction to research methodology; Writing a Research Proposal; Ethics; Accessing Literature & Endnote; The structure of a research report; Writing up your research results

HIGH VOLTAGE ENGINEERING
Introduction to High Voltage Engineering; Conduction and breakdown in Gasses, Liquids, and Solids; Generation and measurement of High Voltages; Non-destructive Testing of Materials and Electrical Apparatus; High Voltage Testing of Electrical Apparatus

INNOVATION MANAGEMENT AND ENTREPRENEURSHIP
Opportunity Cost; Economic Systems and South Africa; Demand, Supply and Prices; Investment and Inflation; Economic Growth and Business Cycles; A Business Marketing Perspective; Business Marketing Strategies; Managing Innovation and New Industrial Product Development; Supply Chain Management; Entrepreneurship; Managing Innovation; Project management concepts knowledge areas and process groups; Constraints in a project environment; Tools and techniques used in different stages of a project life cycle; Application of common project management tools and techniques such as Work Breakdown Structure, Gantt chart, Network diagram and Critical path Method; Net present value and Internal rate of return; Resource scheduling problems; Project quality concepts; Typical content of Business Plan

POWER SYSTEM ENGINEERING 1
Components of Power System; Transmission Line Constants; Performance of Transmission Lines (Short, Medium and Long Lines); Power Flow Analysis; Power system Stability

POWER SYSTEM ENGINEERING 2
Power System Transients Analysis (Classical method, Application of Laplace transform); Harmonics in Power System; Switching transient in Power Systems); Travelling Waves; Magnetically Coupled Circuits

PV AND ENERGY STORAGE SYSTEMS
Introduction to Solar principles and Solar panel technology; PV module sizing; Temperature impact on Solar module voltage; Introduction to off-grid, hybrid and UPS systems; Inverters; General storage technology principles; Battery System calculation and design

RENEWABLE ENERGY TECHNOLOGY
Solar energy: atomic description of silicon; light absorption and charge carriers; the electric field and PV voltage; equivalent circuit; formation of cells to modules to arrays; I–V curves. PV structures: semi-crystalline; polycrystalline; thin-film cells; Gallium Arsenide cells; multi-junction cells; characterization. View of efficiency; maximum power transfer; safety; aesthetics and the environment; PV arrays and systems: designing arrays to achieve specified peak power and energy; effects of ambient temperature and shading; system economics; Use and compile

insolation data; Maximum power point tracking; Solar Power (CSP) technologies: solar dish; parabolic troughs; central receiver systems; energy storage calculations; Fuel cells: operation fundamentals; types of cells; energy calculations; safety; Battery technologies: cover the most prevalent and emerging technologies; lifetime optimization methods; safety; maintenance; Wind power systems: system design fundamentals; efficiency; power transfer; safety; aesthetics and the environment; Distributed generation and hybrid power systems: circuit configurations; optimal power transfer; grid and off-grid solutions; power dimension exercise; case studies; Power Electronics: design fundamentals; DC-DC converters; safety; protection

STATISTICS AND PROBABILITY

Exploring Univariate Data; Types of data; Introduction to Probability; Discrete Distributions; Continuous Distributions; Bivariate Data; Samples and Experiments; Estimation; Tests of Significance

11. GENERAL INFORMATION

- Central Applications Office (CAO) Private Bag X06, Dalbridge, 4014
- Contact (Office No.) 031-2684444, Website: www.cao.ac.za
- Engineering Council of South Africa (ECSA) Private Bag X691, Bruma, 2026 Contact (Office No: 011-6079500)
- 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
- South African Qualifications Authority (SAQA) Postnet Suite 248, Private Bag X06, Waterkloof, 0145; Contact: 012 482 0858; Website: www.saqa.org.za